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North Carolina Department of Transportation
Division of Highways
Statewide Planning Branch

SANFORD THOROUGHFARE PLAN TECHNICAL REPORT

1994

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SANFORD THOROUGHFARE PLAN TECHNICAL REPORT

MARCH 1994

Prepared by:

North Carolina Department of Transportation
Division of Highways
Statewide Planning Branch

In cooperation with:

United States Department of Transportation
Federal Highway Administration

City of Sanford

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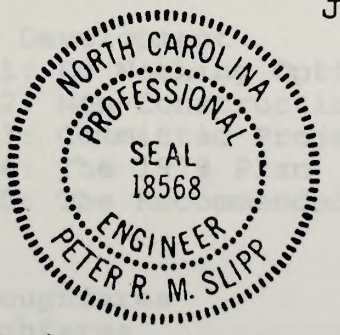
Produced by:

Statewide Planning Branch Manager:	M. R. Poole, Ph.D., P.E.
Thoroughfare Planning Engineer:	A. B. Norwood, P.E.
Project Engineer:	P. R. M. Slipp, P.E.
Technician:	J. M. Neely



Peter R M Slipp 31 March 1994

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CONTENTS

CHAPTER	TITLE	PAGE
1	Introduction	1
2	Thoroughfare Planning Principles	3
	Objectives	
	Operational Efficiency	
	System Efficiency	
	Functional Classification	
	Idealized Major Thoroughfare System	
	Thoroughfare Planning Principles Application	
3	Model Development	11
	Study Area	
	Street Network	
	Data Requirements	
	Traffic Counts	
	Socioeconomic Data	
	Commercial Vehicles	
	Trip Generation	
	Through Trips	
	Internal Data Summation	
	Internal Trip Distribution	
	Model Calibration	
	Accuracy Checks	
	Special Considerations	
	Data Projection	
	Socioeconomic Data	
	Through and External Trips	
	Internal Trips	
4	Existing System Analysis	51
	Capacity and Levels of Service	
	Existing System Volume/Capacity Analysis	
5	Alternative Plans Development	59
	Alternative 1: Do Nothing Option	
	Alternative 2: Non-Construction Measures	
	Alternative 3: Committed Projects Only	
	Alternative 4: The 1979 Plan	
	Alternative 5: The Recommended Plan	
6	Recommendations	73
	Freeway Thoroughfares	
	Major Thoroughfares	
	Minor Thoroughfares	
	Benefits, Costs, And Impacts Analysis	
	Project Priorities	

7 Implementation 95
Subdivision Control
Official Street Map
Future Street Line Ordinance
Zoning
Redevelopment
Municipal Service Districts
Capital Improvements Program
Development Reviews
Impact Fees
State Funding Sources

Appendix A 101
1990 Socioeconomic Data
2010 Socioeconomic Data
2020 Socioeconomic Data

Appendix B 107
1990 Internal Data Summary
2010 Internal Data Summary
2020 Internal Data Summary

Appendix C 117
Trip Length Distribution
External Station Traffic Volumes

Appendix D 121
Recommended Subdivision Ordinances
Definitions
Design Standards

Appendix E 131
Thoroughfare Plan Street Tabulation
Thoroughfare Cross Sections
Cross Section Explanations
Cross Section Illustrations

TABLES

NUMBER	TITLE	PAGE
1	Daily Capacity For Level Of Service D	13
2	Sanford Trip Production Rates	16
3	Sanford Ground Count To Computer Model Comparison	19
4	Sanford Base Year To Design Year Trip Comparison	21
5	Sanford Population Data	21
6	Sanford 1986-1990 Traffic Accident Summary	54
7	Sanford Benefits, Costs, And Impacts Estimates	87
8	Sanford Project Priority Groups	90
9	Sanford 1990 Base Year Dwelling & Vehicle Summary	101
10	Sanford 1990 Base Year Employment Summary	102
11	Sanford 2010 Design Year Dwelling & Vehicle Summary	103
12	Sanford 2010 Design Year Employment Summary	104
13	Sanford 2020 Design Year Dwelling & Vehicle Summary	105
14	Sanford 2020 Design Year Employment Summary	106
15	Sanford 1990 Base Year Internal Data Summary	107
16	Sanford 2010 Design Year Internal Data Summary	110
17	Sanford 2020 Design Year Internal Data Summary	113
18	Sanford 1990 Base Year Trip Length Distribution	117
19	Sanford 2010 Design Year Trip Length Distribution	118
20	Sanford 2020 Design Year Trip Length Distribution	119
21	Sanford External Station Traffic Volumes	120
22	Sanford Thoroughfare Plan Street Tabulation And Recommendations	132

FIGURES

NUMBER	TITLE	PAGE
1	Idealized Thoroughfare Plan	9
2	Traffic Modeling Process	23
3	Sanford Study Area	25
4	Sanford 1990 Base Year Street Network	27
5	Sanford 1990 Base Year Traffic Count Locations	29
6	Sanford 1990 Base Year Dwellings And Employment	31
7	Sanford Trip Length Frequency: Home-Based-Work Trips	33
8	Sanford Trip Length Frequency: Other-Home-Based Trips	35
9	Sanford Trip Length Frequency: Non-Home-Based Trips	37
10	Sanford Trip Length Frequency: External-Internal Trips	39
11	Sanford Dwelling Unit Distribution	41
12	Sanford Employment Distribution	43
13	Sanford External Station Traffic: US-Numbered Routes	45
14	Sanford External Station Traffic: NC-Numbered Routes	47
15	Sanford External Station Traffic: SR-Numbered Routes	49
16	Levels Of Service	55
17	Sanford Existing Network Capacity Deficiencies In Design Year 2020	57
18	Committed Projects Only Deficiencies In Design Year 2020	65
19	Sanford 1979 Thoroughfare Plan	67
20	Sanford 1979 Plan Deficiencies In Design Year 2020	69
21	Sanford 1992 Thoroughfare Plan	71
22	Sanford Project Locations	93
23	Typical Thoroughfare Cross Sections	141

INTRODUCTION

This report documents the findings of a study of Sanford's thoroughfare system which began in 1990 and resulted in the mutual adoption of the Sanford Thoroughfare Plan by the City of Sanford and the State of North Carolina in 1992. The previous Sanford Thoroughfare Plan was adopted in 1979, which superseded the original one adopted in 1965.

Staff personnel from the North Carolina Department of Transportation met twice with the Sanford Planning Board and once with the Lee County Planning Board to discuss thoroughfare planning principles, provide technical information, and receive local input on the goals and needs of the community. The Department also met six times with the Sanford Board of Aldermen to provide it with information and to receive guidance on the plan. The Department held two public information workshops for interested citizens to receive their input on the recommended plan; numerous comments were received at these two information sessions. The Board of Aldermen conducted a public hearing on the recommended thoroughfare plan on 3 March 1992 and adopted a revised version of it on 21 April 1992. The plan was made official when the North Carolina Board of Transportation adopted it on 8 May 1992, in accordance with North Carolina General Statute 136-66.2.

Projected travel was the basis for the development of the thoroughfare plan. Alternatives were developed using the basic thoroughfare planning concepts described in Chapter 2 with consideration given to feasibility, local needs, and environmental impacts. Every effort was made to use as much of the existing street system as possible to minimize costs and environmental impacts.

Table 22 in Appendix E summarizes information on the thoroughfares in tabular form. The recommended street cross sections are based on expected traffic volumes. Before construction begins, a detailed review of each project must be made to insure that changing conditions have not affected the recommendations.

The recommended improvements are shown with their costs and benefits in order to define a recommended order of implementation. Responsibility for the proposed construction projects will be shared by the City of Sanford and the State of North Carolina. In order for the plan to be effective, the City and the State must procure in advance or protect by legal controls the right-of-way necessary for the proposed improvements. The thoroughfare plan was based on the anticipated growth of the urban area. Actual growth rates and patterns may differ somewhat from those logically anticipated, and it may become desirable to accelerate or retard the development of thoroughfares or to make revisions to the plan to accommodate such variations in urban development. The entire

plan may need to be reviewed in detail every 10 years or so to bring it into line with changes in the rate of development and other comprehensive plans for the area. The thoroughfare plan should be consistent with other components of a comprehensive plan for the development of the urban area.

The City proposed two changes to the thoroughfare plan in a resolution adopted by the Board of Aldermen on 16 November 1993. These proposed changes were the addition of Hill Avenue from Hawkins Avenue (US1BUS) to Horner Boulevard (US421) as a minor thoroughfare and the addition of Courtland Drive from Third Street (SR1515) to Harkey Road as a minor thoroughfare. These proposed changes were mutually adopted by the North Carolina Board of Transportation on 4 February 1994, making them official in accordance with North Carolina General Statute 136-66.2.

THOROUGHFARE PLANNING PRINCIPLES

OBJECTIVES

The urban street system typically occupies 25 to 30 percent of the total developed land in an urbanized area. Since the system is permanent and expensive to build and maintain, much care and foresight must be exercised in its development. Thoroughfare planning is the process public officials use to assure the development of the most appropriate street system to meet the existing and future travel needs within the urbanized area.

The primary purpose of a thoroughfare plan is to guide the development of the urban street system in a manner consistent with changing travel demands. Proper planning for street development can avoid costly and needless expense. A thoroughfare plan will enable street improvements to be made as traffic demands increase and help to eliminate unnecessary improvements. By developing the urban street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained, requiring a minimum amount of land for street purposes. In addition to providing for traffic needs, the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present and future population and commercial enterprises affects major street and highway locations. Conversely, the location of major streets and highways within the urbanized area can influence the urban development pattern.

Other objectives of a thoroughfare plan include:

1. To provide for the orderly development of an adequate major street system as land development occurs;

2. To reduce travel and transportation costs;

3. To reduce the cost of major street improvements to the public through the coordination of the street system with private action;

4. To enable private interests to plan their actions, improvements, and developments with full knowledge of public intent;

5. To minimize disruption and displacement of people and businesses through long-range advance planning for major street improvements;

6. To reduce environmental impacts, such as air pollution, resulting from transportation activities;

7. To increase travel safety.

Thoroughfare planning objectives are achieved by improving the operational efficiency of thoroughfares and by improving the system efficiency through system coordination and layout.

OPERATIONAL EFFICIENCY

A street's operational efficiency is improved by increasing the capability of the street to carry vehicular traffic. A street's capacity is defined as the maximum number of vehicles which can pass a given point on a roadway during a given period of time under the prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, the nature of the traffic, and the weather.

Physical methods to increase vehicular capacity include street widening, intersection improvement, vertical and horizontal alignment improvement, and roadside obstacle elimination. For example, widening a street from two to four travel lanes more than doubles its capacity by providing additional maneuverability for traffic. Impedances to traffic flow caused by slow moving or turning vehicles and by adverse horizontal and vertical alignments are thereby reduced.

Operational methods to improve street capacity include:

1. Control of access: A roadway with complete access control can often carry three times the traffic handled by a non-controlled-access street with identical lane width and number;

2. Parking removal: This increases capacity by providing additional street width for traffic flow and by reducing friction to such flow caused by parking and unparking vehicles;

3. One-way operation: Initiating one-way traffic operations can increase the capacity of a street by 20 to 50 percent depending upon turning movements and overall street width. One-way streets can also improve traffic flow by decreasing potential traffic conflicts and by simplifying traffic signal coordination;

4. Reversible lanes: These lanes may be used to increase street capacity in situations where heavy directional traffic flows occur during peak periods;

5. Signal phasing and coordination: Uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operations;

Altering travel demand is a third method to improve the efficiency of the existing street system. Travel demand can be reduced or altered in the following ways:

1. Encourage people to form carpools and vanpools for journeys to work and other trip purposes. This reduces the number of vehicles on the roadway and raises the people-carrying capability of the street system;

2. Encourage the use of public transit and bicycles;

3. Encourage industries, businesses, and institutions to stagger work hours or establish variable work hours for employees. This will reduce the travel demand during peak periods and spread it over a longer time frame;

4. Encourage planning for the use or redevelopment of land in a more travel efficient manner.

SYSTEM EFFICIENCY

The development of a more efficient street system to better serve travel desires is another means for altering travel demand. A more efficient system can reduce travel distances, times, and costs. Improvements in system efficiency can be achieved through the concept of functional classification of streets and through development of a coordinated major street system.

FUNCTIONAL CLASSIFICATION

Streets perform two primary functions--traffic service and land service, which when combined, are basically incompatible. The conflict is not serious if both traffic and land service demands are low. However, when traffic volumes are high, conflicts compounded by uncontrolled and intensely used abutting property lead to intolerable traffic flow friction and congestion.

The underlying concept of the thoroughfare plan is that it provides a functional system of streets which permits travel from origins to destinations with directness, ease, and safety. Different streets in the system are designed and called on to perform specific functions, thus minimizing the traffic and land service conflict. Streets are categorized as to function as local access streets, minor thoroughfares, or major thoroughfares.

Local access streets provide access to abutting property. They are not intended to carry heavy volumes of traffic and should be located such that only traffic with origins and destinations on the streets would be served. Local streets may be further classified as either residential, commercial, or industrial depending upon the type of land use which they serve.

Minor thoroughfares are more important streets in the city system. They collect traffic from local access streets and carry it to the major thoroughfare system. They may in some instances supplement the major thoroughfare system by facilitating minor

through traffic movements. A third function which may be performed is that of providing access to abutting property. They should be designed to serve limited areas so that their development as major thoroughfares will be prevented.

Major thoroughfares are the primary traffic arteries of the city. Their function is to move intra-city and intercity traffic. The streets which comprise the major thoroughfare system may also serve abutting property, however, their major function is to carry traffic. They should not be bordered by uncontrolled strip development because such development significantly lowers the capacity of the thoroughfare to carry traffic, and each driveway is a danger and an impediment to traffic flow. Major thoroughfares may range from a two-lane street carrying minor traffic volumes to major expressways with four or more traffic lanes. Parking normally should not be permitted on major thoroughfares.

IDEALIZED MAJOR THOROUGHFARE SYSTEM

A coordinated system of major thoroughfares forms the basic framework of the urban street system. A major thoroughfare system which is most adaptable to desired lines of travel within an urban area and which permits movement between various areas of the city with maximum directness is the radial-loop system. This system consists of several elements: radial streets, crosstown streets, loop streets, and bypasses. Figure 1 shows this system.

Radial streets provide for traffic movement between points located in the outskirts of the city and the central area. This is a major traffic movement in most cities, and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

If all radial streets crossed in the central area, an intolerable congestion problem would result. A system of crosstown streets which forms a loop around the central business district is needed to avoid this problem. This system allows traffic moving from origins on one side of the central area to destinations on the other side to follow the areas's border and allows central area traffic to circle and then enter the area near the appropriate destination. The effect of a good crosstown system is to free the central area of crosstown traffic, thus permitting the central area to function better in its role as a pedestrian shopping area.

Loop streets move traffic between suburban areas of the city. Although a loop may completely encircle the city, a typical trip may go from an origin near a radial thoroughfare to a destination near another radial thoroughfare. Loop streets do not necessarily carry heavy volumes of traffic, but they function to help relieve it in central areas. One or more loops may exist, depending upon the size of the urban area, and they should be spaced one half-mile to one mile apart, depending upon the intensity of land use.

A bypass is generally designed to carry traffic through or around the urban area, thus providing relief to the city street system by removing from it traffic which has no desire to be in the city. Bypasses are usually designed to through-highway standards, with control of access. Occasionally, a bypass with low traffic volumes can be designed to function as a portion of an urban loop. The general effect of bypasses is to expedite the movement of through traffic and to improve traffic conditions within the city. By freeing the local streets for use by shopping and home-to-work traffic, bypasses tend to increase the economic vitality of the local area.

THOROUGHFARE PLANNING PRINCIPLES APPLICATION

The concepts presented in the discussion of operational efficiency, system efficiency, functional classification, and idealized thoroughfare system are the conceptual tools available to the transportation planner to develop a thoroughfare plan. In actual practice, thoroughfare planning is performed for established urban areas and is constrained by existing land use and street patterns, existing public attitudes and goals, and existing expectations of future land use. Compromises must be made because of these and many other factors that affect major street locations.

Certain basic principles must be followed throughout the thoroughfare planning process as closely as possible. These principles are:

1. The plan should be derived from a thorough knowledge of today's travel, its component parts and the factors which contribute to it, limit it, and modify it;

2. Traffic demands must be sufficient to warrant the designation and development of each major street. The thoroughfare plan should be designed to accommodate a large portion of all major traffic movements on relatively few streets;

3. The plan should conform to and provide for the land development plan of the area;

4. The plan must give consideration to urban development beyond the current planning period. Thoroughfares should be designated on a long-range planning basis to protect rights-of-way for future construction, particularly in outlying or sparsely developed areas which have development potential;

5. The plan must be consistent with the above principles, realistic in terms of travel trends, and economically feasible.

The basic concept of an idealized thoroughfare system has been outlined previously. Many factors influence the final

location, design, and designation of streets on a thoroughfare system. One of the most important factors is the anticipated future traffic demand. In addition to this factor, others which influence the final design include:

1. Location of existing and anticipated major traffic generators such as shopping centers, central business districts, and larger industrial plants;

2. Existing residential patterns, schools, churches, cemeteries, and other social and recreational areas;

3. Topography and hydrology;

4. Location and design of existing highways and streets;

5. Level-of-service to be maintained on the street system;

6. Existing right-of-way and development adjacent to the present street system;

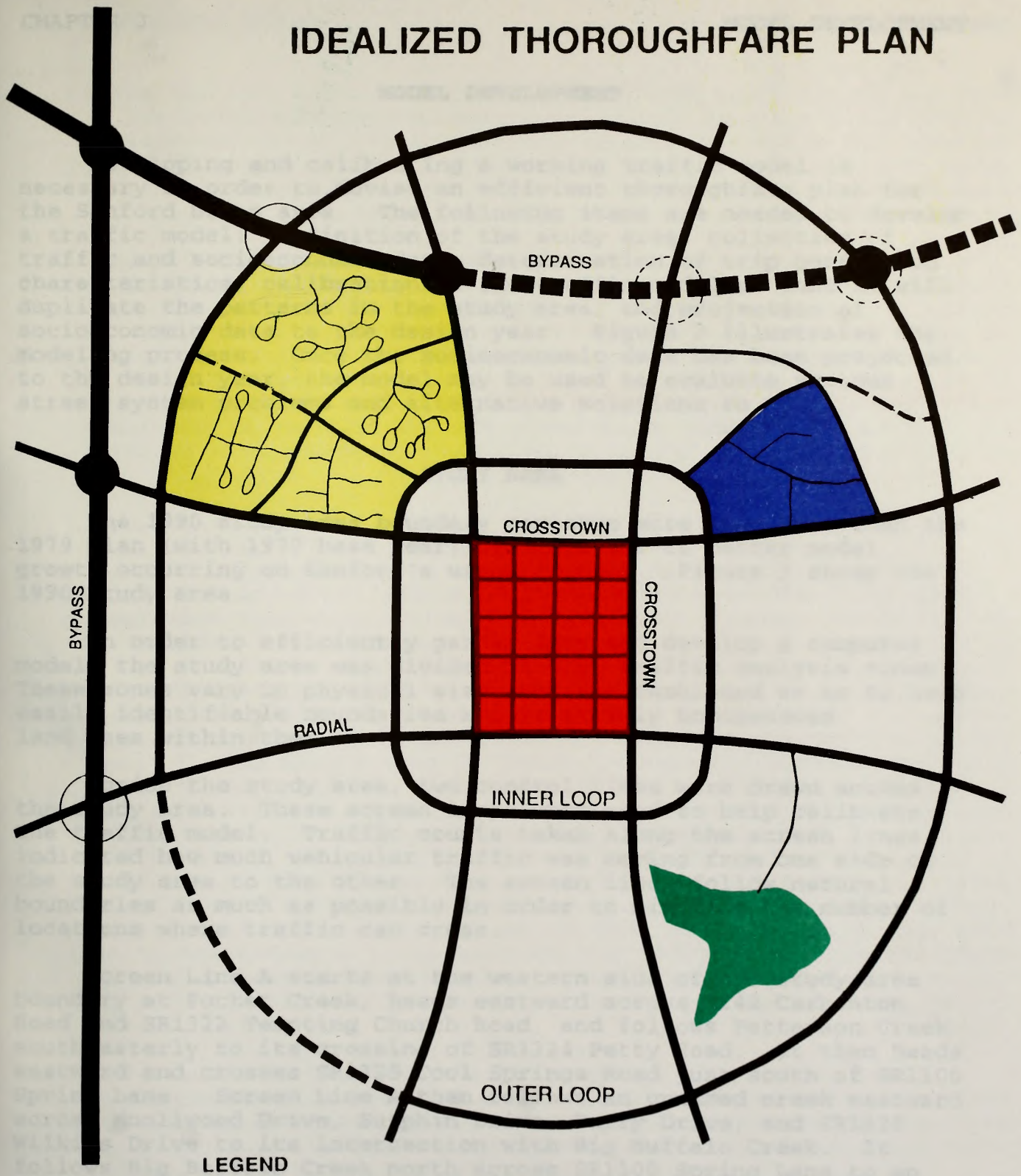
7. Anticipated future land use (this is important since the thoroughfare system will exert a major influence on future land development);

8. Anticipated availability of funds in establishing priorities for future improvements;

9. Environmental impacts of the thoroughfare system and its related highway construction;

10. Availability or anticipated development of other transportation modes, such as public transit, which could serve local travel desires.

IDEALIZED THOROUGHFARE PLAN



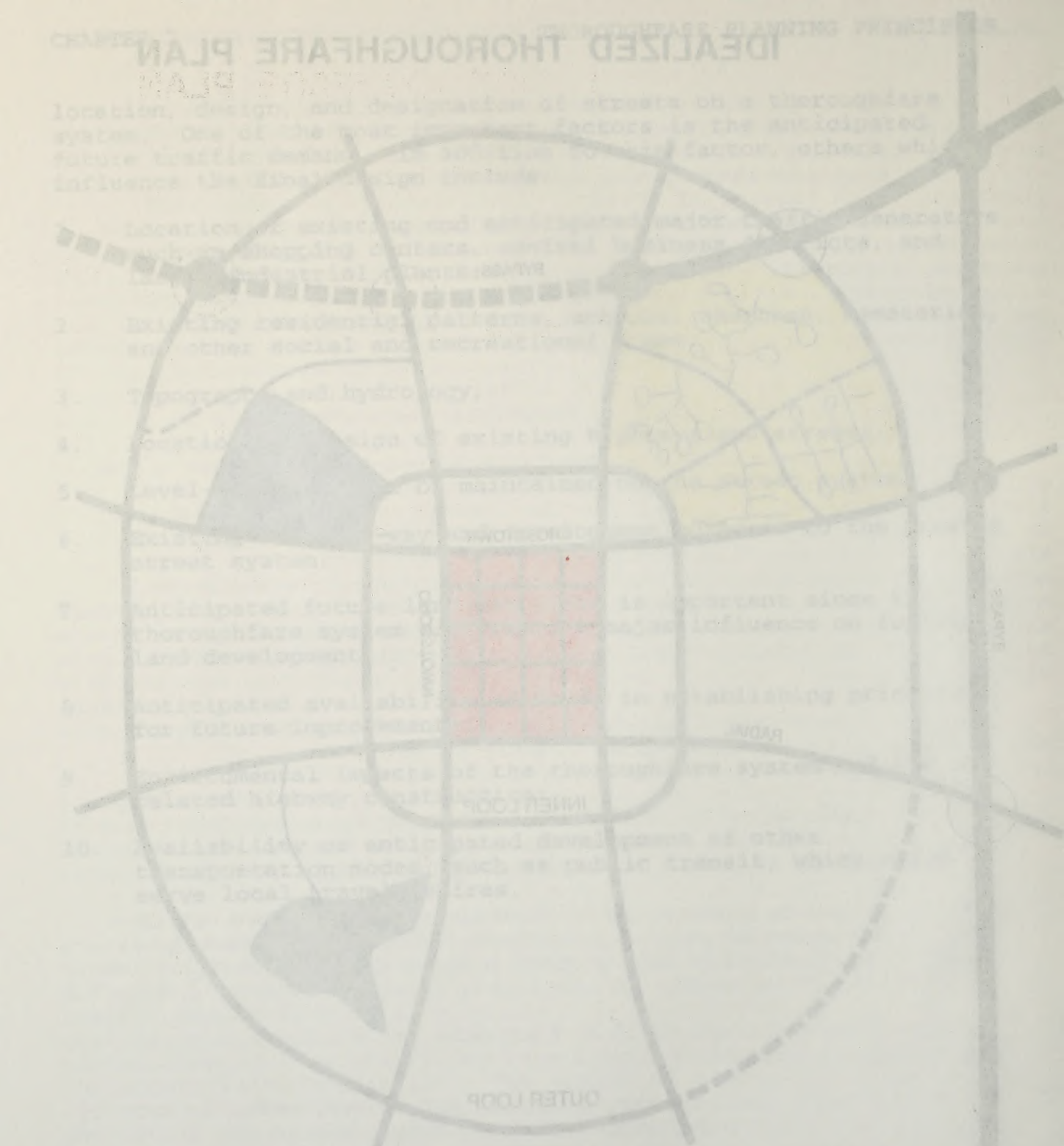
LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE FREEWAY		
MAJOR OTHER		
MINOR THOROUGHFARE		
LOCAL ROAD		
INTERCHANGE		
GRADE SEPERATION		

LAND USES

- COMMERCIAL/BUSINESS
- RESIDENTIAL
- INDUSTRIAL
- PUBLIC/INSTITUTIONAL

FIGURE 1



MODEL DEVELOPMENT

Developing and calibrating a working traffic model is necessary in order to devise an efficient thoroughfare plan for the Sanford urban area. The following items are needed to develop a traffic model: definition of the study area, collection of traffic and socioeconomic data, determination of trip generation characteristics, calibration of the traffic model so that it will duplicate the patterns in the study area, and projection of socioeconomic data to the design year. Figure 2 illustrates the modeling process. Once the socioeconomic data has been projected to the design year, the model may be used to evaluate various street system problems and alternative solutions to them.

STUDY AREA

The 1990 study area boundary contains more land area than the 1979 plan (with 1977 base year) did in order to better model growth occurring on Sanford's urban fringes. Figure 3 shows the 1990 study area.

In order to efficiently gather data and develop a computer model, the study area was divided into 51 traffic analysis zones. These zones vary in physical size, but are fashioned so as to have easily identifiable boundaries and relatively homogeneous land uses within them.

Inside the study area, two control lines were drawn across the study area. These screen lines were used to help calibrate the traffic model. Traffic counts taken along the screen lines indicated how much vehicular traffic was moving from one side of the study area to the other. The screen lines follow natural boundaries as much as possible in order to minimize the number of locations where traffic can cross.

Screen Line A starts at the western side of the study area boundary at Pocket Creek, heads eastward across NC42 Carbonton Road and SR1322 Tempting Church Road, and follows Patterson Creek southeasterly to its crossing of SR1324 Petty Road. It then heads eastward and crosses SR1325 Cool Springs Road just south of SR1100 Spring Lane. Screen Line A then follows an unnamed creek eastward across Knollwood Drive, Sutphin Drive, Perry Drive, and SR1328 Wilkins Drive to its intersection with Big Buffalo Creek. It follows Big Buffalo Creek north across SR1100 Spring Lane to an unnamed creek and then heads across SR1343 Douglas Drive, US1/15/501 Jefferson Davis Highway, Gulf Street, US421 Horner Boulevard, and Steele Street to the meet the Norfolk Southern Railroad track. Screen Line A then departs the railroad track heading east parallel to SR1560 Weatherspoon Street and crosses Greensboro Avenue and US1BUS Hawkins Avenue until it meets the CSX Railroad track. It jogs north along the railroad track and then heads east along the Sanford City Limit, crossing SR1415 Colon

Road and SR1002 Lower Moncure Road. Screen Line A then follows an unnamed creek eastward to its intersection with Lick Creek and follows Lick Creek north to an unnamed creek. It follows this creek eastward and projects across SR1537 Poplar Springs Church Road north of the SR1509 San Lee Drive intersection until it reaches the eastern boundary of the study area.

Screen Line B starts at the northern boundary of the study area and proceeds south along the CSX Railroad track, crossing SR1423 Farrell Road, SR1419 Brickyard Road, and SR1415 Colon Road. It continues along the CSX Railroad track through the central urbanized area of Sanford, crossing SR1560 Weatherspoon Street, Chisholm Street, SR1002 Charlotte Avenue, Wicker Street, US421 Horner Boulevard, SR1107 Fields Drive, and SR1117 Garden Street. Screen Line B continues south along the CSX Railroad track across NC78 Tramway Road and SR1156 Bruce Coggins Road and ends at the southern boundary of the study area.

STREET NETWORK

The goal of the traffic model is to replicate the conditions on the street system. The existing street system must therefore be represented by a street model. The construction of this model must maintain a balance between having too many streets represented so as to cause calibration to become unattainable and having too few streets represented so as to cause the model to not realistically duplicate existing conditions. Generally, all major arterial roadways and some collector streets should be incorporated into the street system model. In the case of a smaller city like Sanford, a higher percentage of low-volume streets will be represented in the model. Arterials represented in the model include US1/US1BYP/US1BUS, US15/US501, US421, NC42, NC78, and NC87. These roadways are represented both in the base year network and the design year network. Figure 4 shows the 1990 base year street network used in the Sanford model (which uses North Carolina Grid System X-Y coordinates). Construction of new streets and widenings of existing streets were added for the design year and are discussed in greater detail later in this report.

Street capacity is an important component of the model, and the volume-to-capacity ratio presents the best indication of existing and future traffic congestion. The capacity ranges for streets in the Sanford model are shown in Table 1.

Speed and street length are the major factors which define the minimum time path from zone to zone. The model uses minimum paths as the basis for assigning traffic to streets on the network. Generally, speeds assigned to links in the Sanford network are slightly below the posted speed limit. Common speeds found in the model are 20, 30, 40, and 50 miles per hour.

TABLE 1
DAILY CAPACITY FOR LEVEL OF SERVICE D

SECTION	RURAL	SUBURBAN	URBAN
		Freeways	
4-lane	54,000	54,000	54,000
6-lane	81,000	81,000	81,000
8-lane	108,000	108,000	108,000
		Divided Roadways	
4-lane	50,000	37,000 - 41,700	18,000 - 22,000
6-lane	75,700	56,500 - 62,600	30,000 - 34,000
		Undivided Roadways	
3-lane	23,200	20,300 - 21,400	12,000 - 16,000
4-lane	48,000	33,500 - 39,400	18,000 - 22,000
5-lane	49,000	35,600 - 39,400	24,000 - 28,000
6-lane	71,100	50,300 - 55,700	30,000 - 34,000
7-lane	73,400	53,400 - 59,200	36,000 - 40,000
		Two Lane Roadways	
18 feet	9,000	8,500	8,000
20 feet	11,000	10,500	9,500
22 feet	12,000	11,500	11,000
24 feet	13,000	12,500	12,000
		One Way Roadways	
2-lane	---	---	14,000
3-lane	---	---	22,000
4-lane	---	---	30,000

All capacities measured in vehicles per day (vpd).

DATA REQUIREMENTS

Development of an adequate traffic model for the study area requires additional data besides the street network information. Traffic counts must be taken to provide a basis for calibrating the computer model. These counts provide a snapshot of traffic conditions in the study area and a benchmark by which to calibrate. Socioeconomic data in the form of housing surveys and employment surveys is needed to generate traffic volumes in the model. Table 9 and Table 10 in Appendix A show the 1990 base year socioeconomic data.

Traffic Counts

The model must be calibrated against existing conditions in the study area. Traffic counts must be taken at various locations around the study area in order to calibrate the model. Figure 5 shows the traffic count locations for the Sanford study area. These traffic counts were composed of three types.

Cordon line counts were taken at all locations where roadways crossed the study area boundary; these locations are known as external stations. These counts indicate how much traffic is entering the study area from outside its boundaries. Cordon line counts on major highways entering the planning area were generally taken over a 48-hour period with traffic recorded in 1-hour increments.

Screen line counts were taken at all locations where streets crossed either of the two screen lines. These counts were used to determine the volumes of traffic moving across major portions of the study area. These counts also provided the primary accuracy check of the traffic model. Screen line counts were generally taken over a 48-hour period.

Coverage counts were taken on various streets within the study area. These counts serve as a secondary accuracy check for the model; by matching the volumes of the coverage counts, the model can be made to more closely duplicate the existing conditions in the study area. Coverage counts were taken over either 48-hour or 24-hour periods.

Two vehicle classification counts were taken in Sanford, one on US421 Horner Boulevard at the Atlantic Western Railroad track and the other on US1/15/501 Jefferson Davis Highway below SR1334 Pendergrass Road. These traffic counts give some indication of the vehicle mix on primary roads in Sanford.

Socioeconomic Data

The necessary socioeconomic data comes in the form of housing surveys and employment surveys. The dwelling unit count forms the basis for production of traffic, and the employee count forms the basis for attraction of traffic. The model assumes that houses produce trips and that jobs attract trips.

The best indicator of a household's potential to generate trips is its disposable income. No acceptable method of efficiently determining household disposable income exists, so dwelling unit type and quality are used as surrogate indicators. Dwelling units are divided into five categories of trip generation potential: excellent, above-average, average, below-average, and poor. Group housing, such as college dormitories or military barracks, is inventoried separately. Each dwelling unit category has a slightly different trip generation rate. Figure 6 shows the

dwelling unit counts for each traffic zone.

Employment is used as a measure of potential trip attraction. A survey of employers in the study area was conducted at the same time as the housing survey. Employment was categorized by Standard Industrial Code (SIC) into five categories as follows:

SIC 1-49 INDUSTRY
Agriculture, Mining, Construction, Manufacturing, Transportation

SIC 50-54, 56-57, 59 SALES
Wholesale and Retail Trade

SIC 55, 58 SPECIAL
Gasoline Sales, Restaurants, Convenience Marts

SIC 60-67, 91-97 OFFICE
Finance, Insurance, Banking, Government

SIC 70-89 SERVICE
Hotels, Garages, Recreation, Health, Education, Personal Services

The category totals, by zone, were entered into a standard regression equation to develop the attractions for each zone.

Commercial Vehicles

Commercial vehicles have different trip generation characteristics than privately-owned automobiles in domestic use. A survey of commercial vehicles was performed at the same time as the employment survey.

TRIP GENERATION

The trip generation process is a procedure which uses the external station volumes, dwelling unit data, and employment data to generate traffic volumes in the model to duplicate the volumes on the actual, existing street network. Through trip tables are developed from a computer model using external (cordon) station traffic. External-internal trip tables are developed from the gravity model using socioeconomic data and external station traffic. These two trip tables are then added together to produce a total trip table.

Traffic inside the study area consists of three types: through trips, external-internal trips, and internal trips. The thoroughfare planning definition of a trip is slightly different from the general public's definition. Technically, a trip has one origin and one destination, while a lay definition of a trip would count a group of trips or chain of short trips as one long trip. Through trips are produced outside the study area, move through the study area without stopping, and end at a destination outside

the study area. External-internal trips have one end point inside the study area and the other point outside it; they may either originate inside the area and proceed outward or originate outside the area and proceed inward. Internal trips have both their origin and their destination inside the study area; they never cross the cordon line (study area boundary). To better analyze them, they are broken down by purpose: home-based-work, other-home-based, and non-home-based.

Through Trips

The through trip table for the Sanford study was generated using the procedures of Synthesized Through Trip Table For Small Urban Areas (Technical Report 3).[1] This approach substitutes for the external origin and destination survey procedure which has fallen into disuse since the 1970s. The through trips are then subtracted from the external station volumes to derive the external-internal trips.

Internal Data Summation

INTERNAL DATA SUMMATION (IDS 1.05) is a computer program which takes the external-internal traffic volumes, the dwelling data, the employment data, the generation rates, and the regression equations and generates the trip productions and trip attractions needed for use in the gravity model. The IDS procedure has been adapted to the microcomputer for use with a PROFESSIONAL WRITE (PROWRITE 2.2) worksheet. This worksheet has three parts: dwellings, employment, and calculations. Table 2 shows the trip production rates used in the Sanford study. The average rate for dwelling units in the 1990 base year was 8.7 trips per dwelling unit.

TABLE 2
SANFORD TRIP PRODUCTION RATES

CLASSIFICATION	TRIPS PER DAY
Dwelling Units:	
Excellent	13.0
Above Average	12.0
Average	10.0
Below Average	8.0
Poor	6.0
Commercial Vehicles:	
Autos and Trucks	6.7
Taxis	40.0

Trip attractions where calculated using a standard regression equation which considers attractions to be a function of employment characteristics of the traffic zone. This equation is:

$$Y = AX1 + BX2 + CX3 + DX4 + EX5 + FX6$$

The three types of internal trip attractions and the external-internal trip attractions were generated using the following set of equations derived from the generic equation above.

Home-Based-Work Trip Attractions
$$Y = 1.00X1 + 1.00X2 + 1.00X3 + 1.00X4 + 1.00X5$$

Other-Home-Based Trip Attractions
$$Y = 1.00X1 + 1.80X2 + 8.36X3 + 2.60X4 + 2.55X5 + 0.50X6$$

Non-Home-Based Trip Attractions
$$Y = 1.00X1 + 1.80X2 + 8.36X3 + 2.60X4 + 2.55X5 + 0.30X6$$

External-Internal Trip Attractions
$$Y = 1.00X1 + 1.80X2 + 8.36X3 + 2.60X4 + 2.55X5 + 0.50X6$$

where the X1 through X5 are the numbers of employees categorized by the following groups:

Y = Trips Attracted

X1 = Industry SIC 1-49

X2 = Sales SIC 50-54, 56-57, 59

X3 = Special SIC 55, 58

X4 = Office SIC 60-67, 91-97

X5 = Service SIC 70-89

and where X6 is the number of dwelling units in the zone.

The output of the IDS program is divided into trip productions and trip attractions for each zone, broken down by the four types of trips: home-based-work, other-home-based, non-home-based, and external-internal. The trips are segregated by type because each has a different trip length frequency distribution associated with it. In the Sanford study, the internal trips were broken down into 23% HBW, 55% OHB, and 22% NHB.

Internal Trip Distribution

After the number of trips per traffic zone is determined, they must be distributed to the other zones. The preferred method of distributing trips is called the Gravity Model and states that the number of trips between Zone 1 and Zone 2 is equal to the number

of trips produced in Zone 1, multiplied by the number of trips attracted to Zone 2, multiplied by a travel time factor between the zones, and then divided by the sum of all zone attractions multiplied by their travel time factors.

$$Tij = \frac{Pi * Aj * Fij}{SUM\ \{x=1,n\}\ Ax*Ftx}$$

where:

Tij = the number of trips sent from zone i to zone j

Pi = the number of trips produced in zone i

Aj = the number of trips attracted to zone j

Fij = the travel time factor between zone i and zone j

n = the total number of zone

i = the origin zone number

j = the destination zone number

x = any zone number

The travel time factor or friction factor (F) is critical to the gravity model distribution and must be derived empirically. The travel time factor is dependent on the distance between the traffic zones and the time necessary to travel that distance. The travel time factor is also dependent on the trip purpose. In order to derive the travel time factor, a gravity model calibration program was run with an initial value of travel time factor and a trip length frequency curve for each trip purpose. The initial travel time factor used in the Sanford model was 100 for all trip purposes and time increments. Figure 7 through Figure 10 show the trip length frequency curves for each trip purpose, and Tables 17 through Table 19 in Appendix C show the actual values for the trip length frequency distribution.

MODEL CALIBRATION

The purpose of the traffic model is to predict the traffic on a street system at some future point in time; however, if the model does not do this accurately, then it is useless. The major test of a traffic model's validity is whether or not the model will duplicate the existing traffic pattern on the base year street network. The actual calibration of the model is an iterative process in which incremental changes are made either in the trip generation, the trip distribution, or the street network. The goal of each change is to make the model more accurately reflect the real world conditions upon which it is based. Only when the model can adequately reflect traffic in the base year can

it be used to predict traffic in the future year.

Accuracy Checks

Three different checks have been performed upon this model. The first check is to follow trips through all the steps involved in the model. This check insures that no trips have accidentally been added or subtracted from the model or counted twice. The second check is to compare the model-generated trips across the screen lines with the ground counts taken at those stations. A model accurately reflects the overall travel patterns if the model trips are from 95% to 105% of the ground counts across the screen lines. Table 3 shows the comparison of ground counts to model volumes on the screen lines.

TABLE 3
SANFORD GROUND COUNT TO COMPUTER MODEL COMPARISON

SCREEN LINE	GROUND COUNT	COMPUTER MODEL	MATCH
A (E-W)	60,557	59,716	98.6%
B (N-S)	68,408	65,210	95.3%

The computer model volumes across Screen Line A are very close. The volumes across Screen Line B are slightly low, but still within standards. Screen Line B passes directly through the center of Sanford's central business district (CBD), an area of high circular movements on a tight grid system of streets. The computer model has difficulty replicating the unusual traffic patterns in this particular area.

Special Considerations

The computer model was most successful at replicating traffic patterns on higher-volume roadways, those over 10,000 vehicles per day. In general, as ground count volumes decreased, the computer-generated values became less accurate in matching those counts. Network streets passing through the central business district usually showed less volume than the ground counts indicated because the model could not easily take into account the internal circulation patterns on grid streets in the urban core. Over the entire network, the computer volumes with noticeable differences relative to the ground counts tended to be lower not higher.

DATA PROJECTION

The base year data must be appropriately modified in order to make the model reflect assumed or projected conditions in the

design year. Future year development may or may not occur in the places and in the types anticipated, but an estimate must be made so that the computer model can be made relevant to that future year.

Socioeconomic Data

The Sanford Department of Planning prepared the projections of socioeconomic data used in the computer model. These projections are based upon previously experienced rates and upon the comprehensive land use plan prepared by the City. These projections were used along with the previously-developed regression equation to generate the design year trip productions and trip attractions, in a similar manner to the base year procedure.

Dwelling unit projections show a very modest growth rate of 1.1% annually from 1990 to 2020. The distribution of dwellings among the five classifications of trip production changes very little. Figure 11 shows the percentages of each type of trip.

Employment projections also show a modest growth rate of 1.3% annually. Some shift in the relative percentages for each type of employment will occur, with industrial employment shifting somewhat to office and service employment. Figure 12 shows the distribution for the base and design years.

External And Through Trips

The average daily traffic (ADT) values for the cordon (external) stations in the design year were developed using trend analysis and modified as needed based upon anticipated growth beyond those points. These future volumes were then split into through trips and external trips using the procedures of Technical Report 3. Cordon station traffic was projected to grow at annualized rates of 1.5% to 2.7% on US-numbered routes and 1.8% to 2.3% on NC-numbered routes. Traffic on major SR-numbered routes was projected to grow at annualized rates of 1.2% to 2.9%. Design year ADT values were rounded to the nearest 100 vehicles per day. Table 19 shows the ADT values for each station.

Internal Trips

Internal trips in the design year were produced using IDS and the dwelling unit and employment projections. Table 4 shows the trip types for the base and design years.

TABLE 4
SANFORD BASE YEAR TO DESIGN YEAR TRIP COMPARISON

TRIP TYPE	1990	2010	2020
Internal	111,966	144,887	162,470
External-Internal	64,288	91,690	104,046
Through	8,849	16,780	20,127
Total	185,103	253,357	286,643

All values in vehicles per day.

TABLE 5
SANFORD POPULATION DATA

YEAR	NORTH CAROLINA	LEE COUNTY	PLANNING AREA	JO+ES+WS TOWNSHIPS	SANFORD CITY
1910	2,206,287	11,376	------	6,205	2,282
1920	2,559,123	13,400	------	7,429	2,977
1930	3,170,276	16,996	------	10,134	4,253
1940	3,571,623	18,743	------	11,616	4,960
1950	4,061,929	23,522	------	15,900	10,013
1960	4,556,155	26,561	------	19,162	12,253
1970	5,084,411	30,467	------	22,182	11,716
1980	5,881,766	36,718	------	25,894	14,773
1990	6,628,637	41,374	32,416	27,956	14,475
2000	7,260,748a	49,162a	34,300b	31,100b	31,500b
2010	7,775,979a	54,494a	41,400b	33,600b	38,000b
2020	8,185,240a	59,216a	48,000b	36,300b	45,000b

Townships: JO = Jonesboro, ES = East Sanford, WS = West Sanford
1910-1990 statistics from the United States Bureau of the Census
a = Estimate made by the North Carolina Office of State Budget and Management
b = Estimate made by the Sanford Department of Planning, Community Development, and Inspections

[1] Division of Highways, Synthesized Through Trip Table For Small Urban Areas, Technical Report 3, NCDOT: Raleigh (1980).

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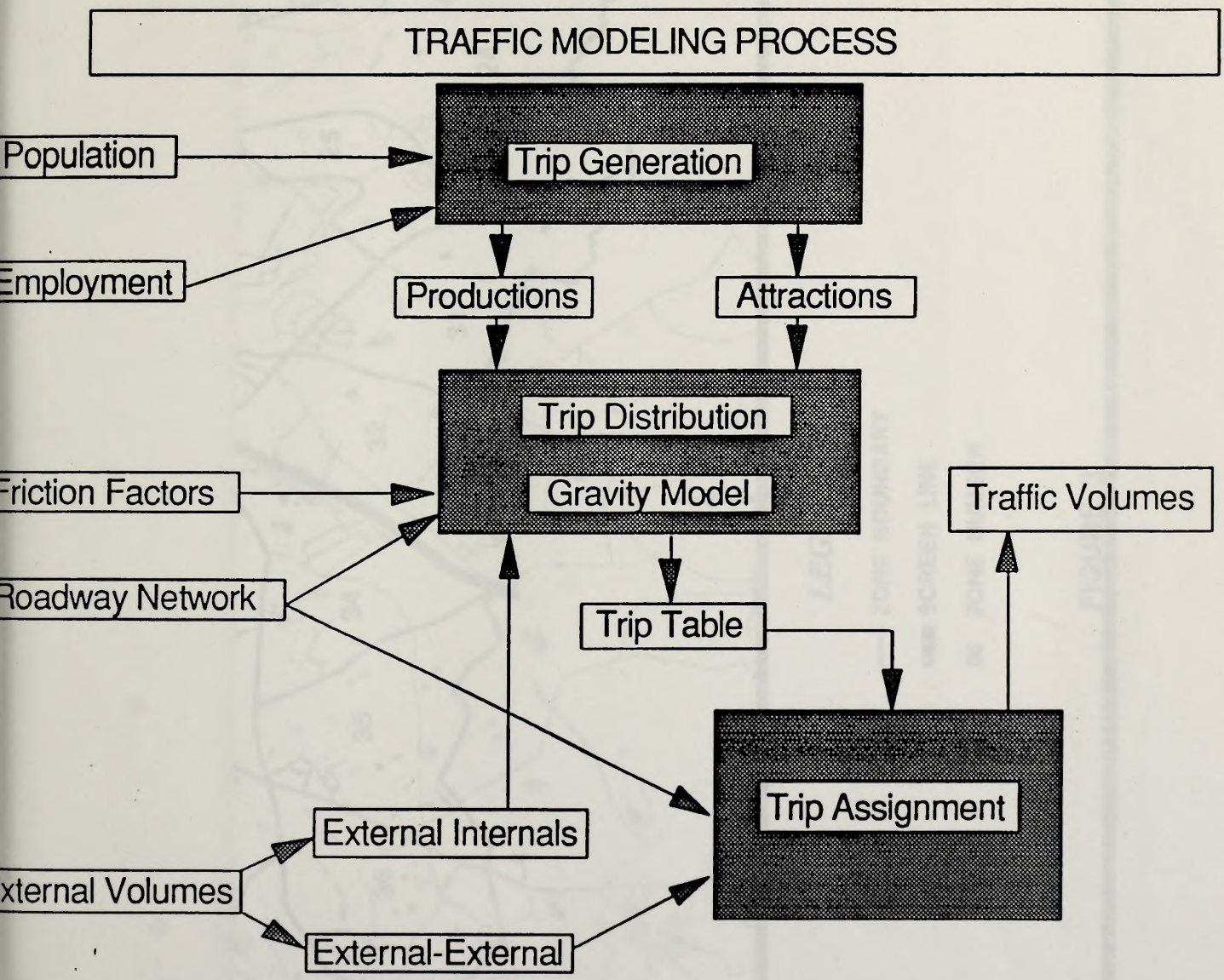
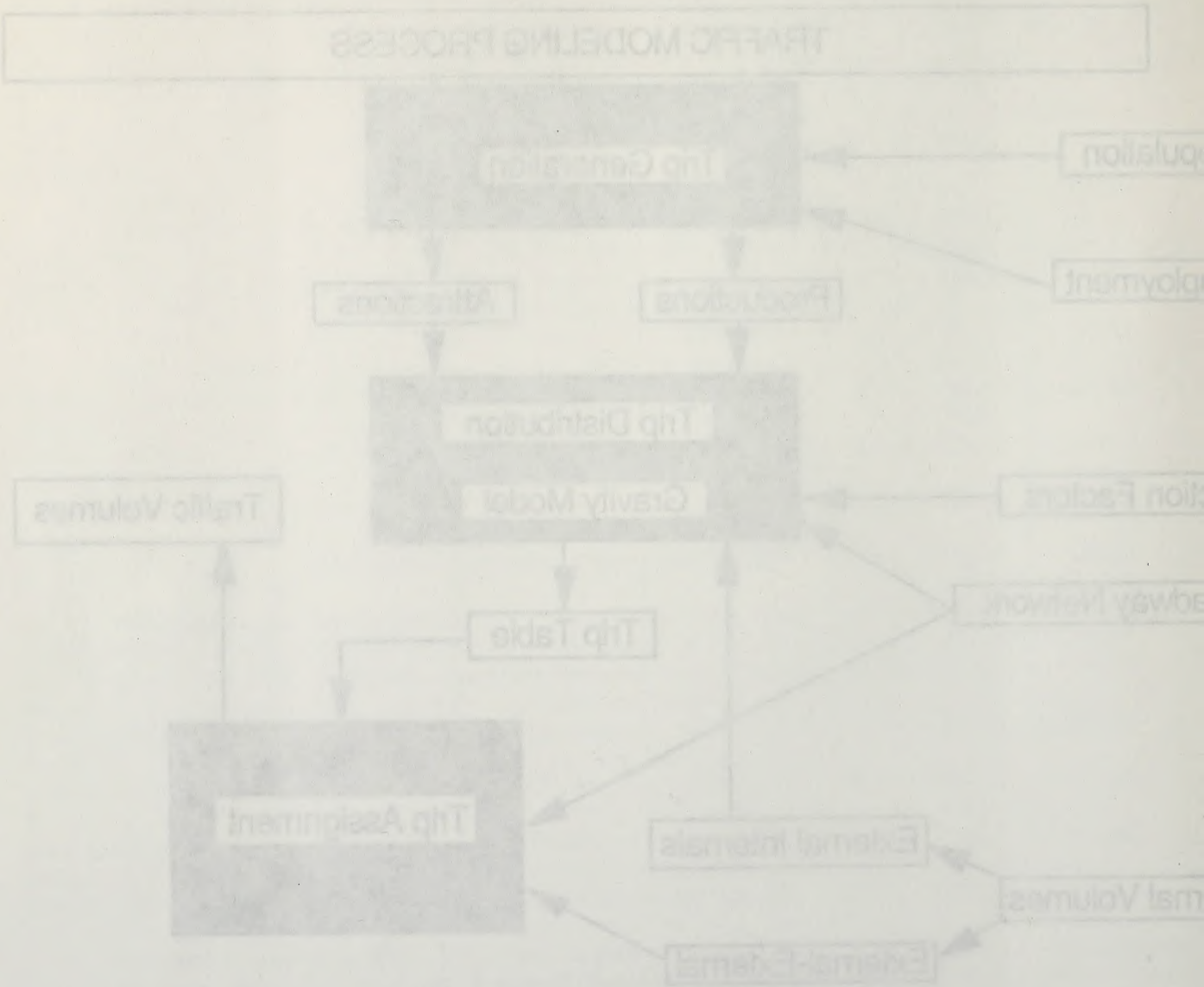
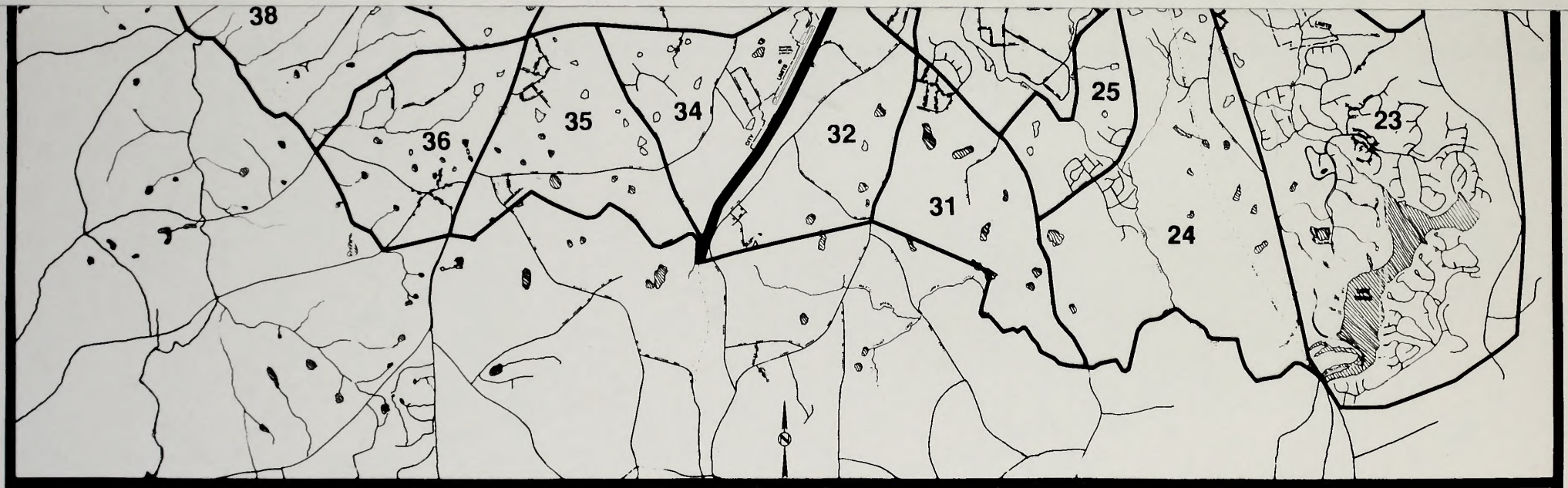

TRAFFIC MODELING PROCESS
Population
Employment
Trip Generation
Productions
Attractions
Trip Distribution
Gravity Model
Friction Factors
Roadway Network
Traffic Volumes
Trip Table
Trip Assignment
External Internals
xternal Volumes
External-External

FIGURE 2





SANFORD STUDY AREA

LEGEND

— ZONE BOUNDARY

▬ SCREEN LINE

00 ZONE NUMBER

CITY OF SANFORD

LEE COUNTY

NORTH CAROLINA

PREPARED BY THE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH

IN COOPERATION WITH

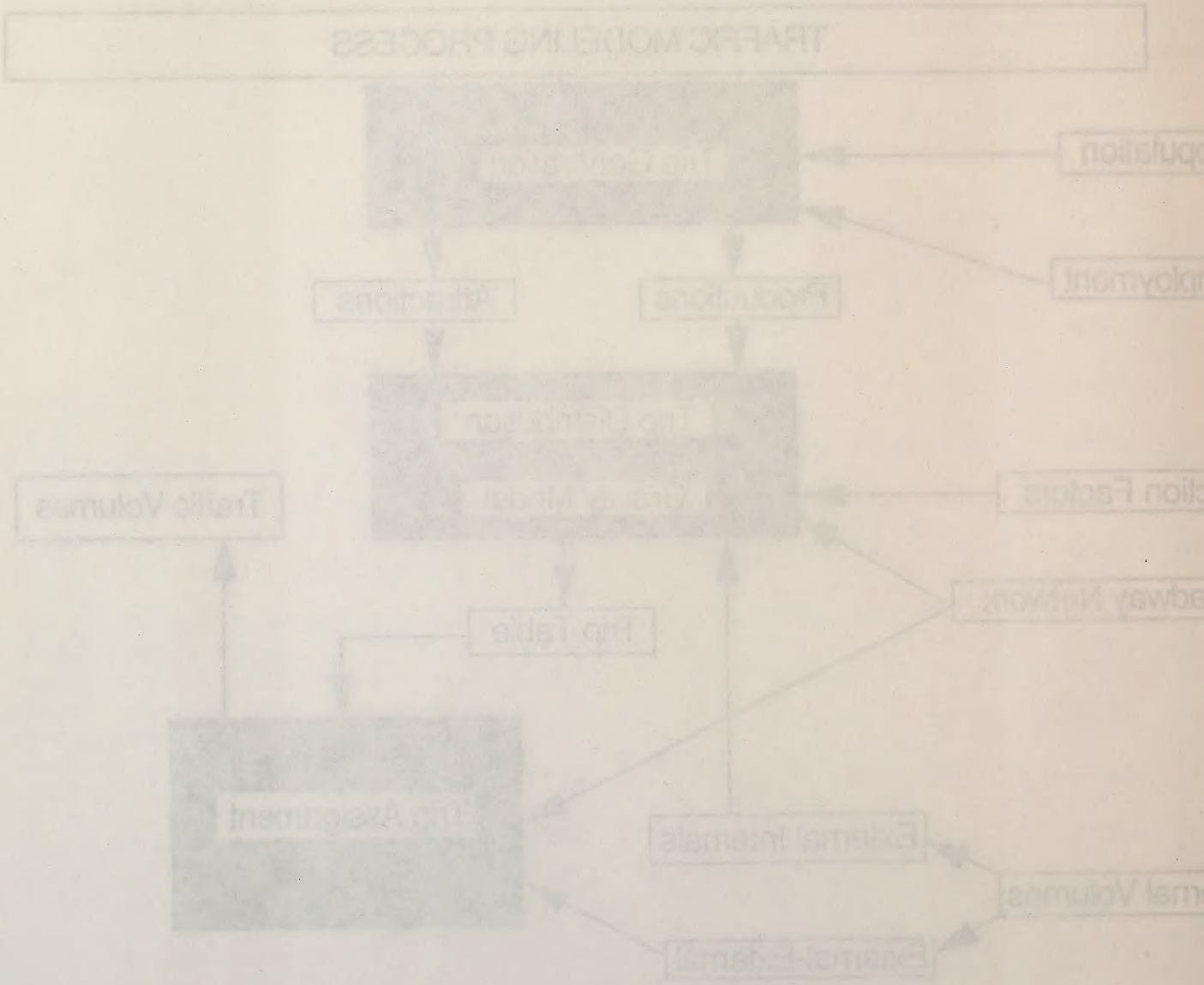
U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

0 2000 4000 6000 8000

SCALE IN FEET

FIGURE 3



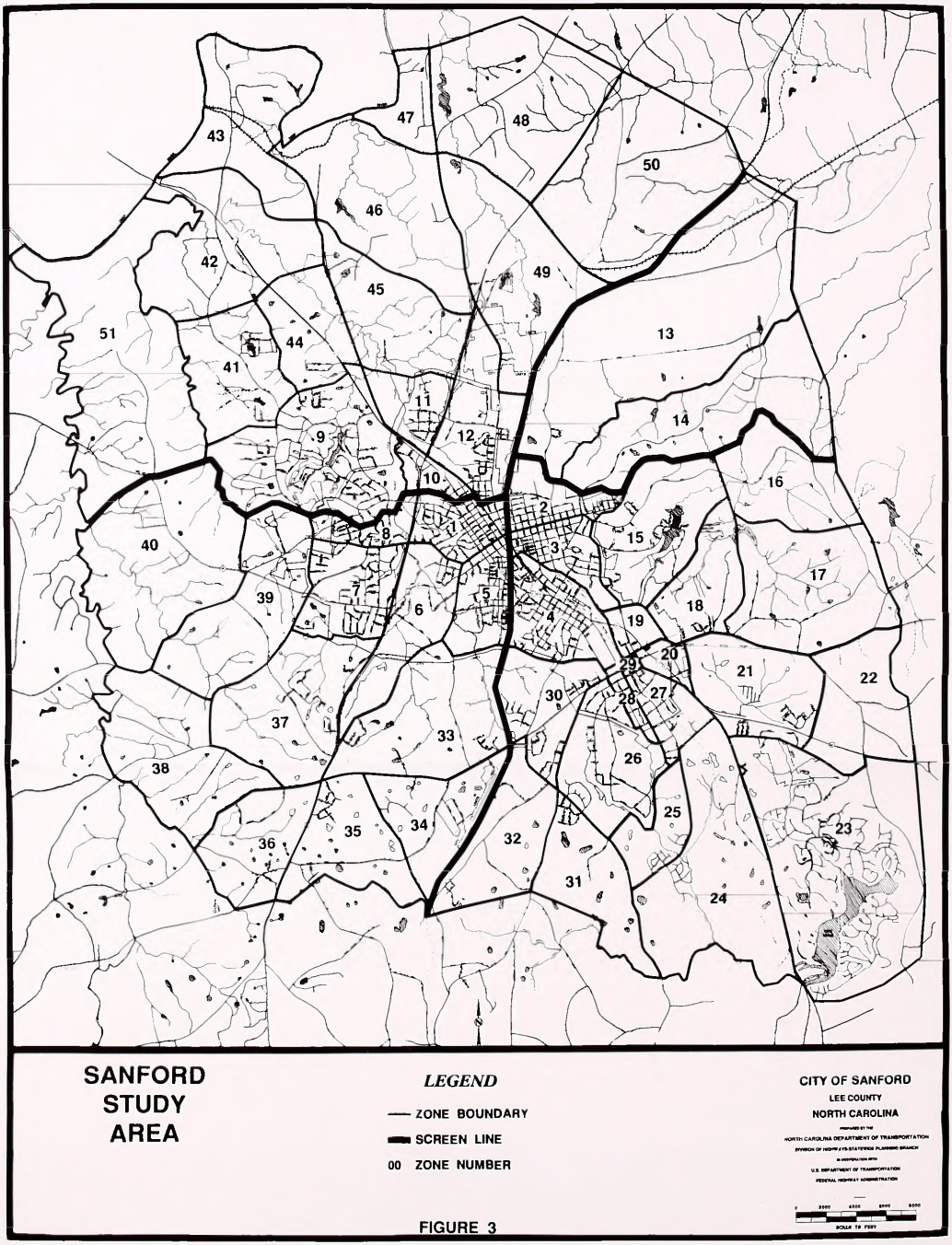
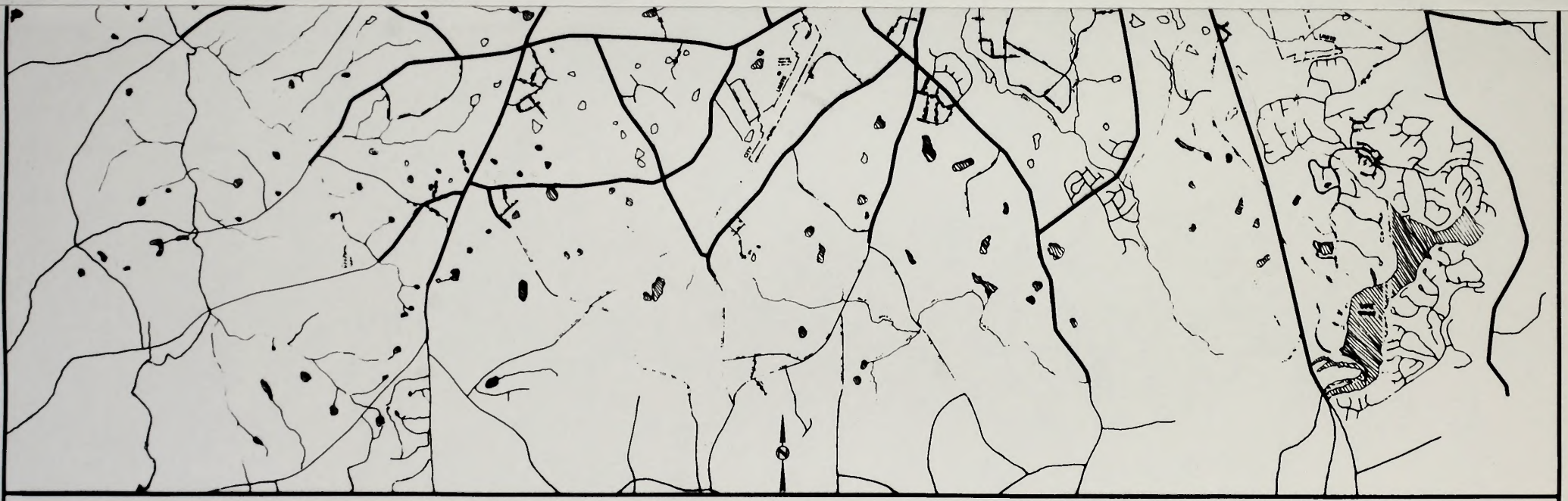

SANFORD
STUDY
AREA
LEGEND
ZONE BOUNDARY
SCREEN LINE
00 ZONE NUMBER
CITY OF SANFORD
LEE COUNTY
NORTH CAROLINA
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
SCALE IN FEET

FIGURE 3



SANFORD BASE YEAR STREET NETWORK

—— MODELED ROADWAY

CITY OF SANFORD

LEE COUNTY

NORTH CAROLINA

PREPARED BY THE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH

IN COOPERATION WITH

U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

0 2000 4000 6000 8000

SCALE IN FEET

FIGURE 4

SANFORD BASE YEAR STREET NETWORK

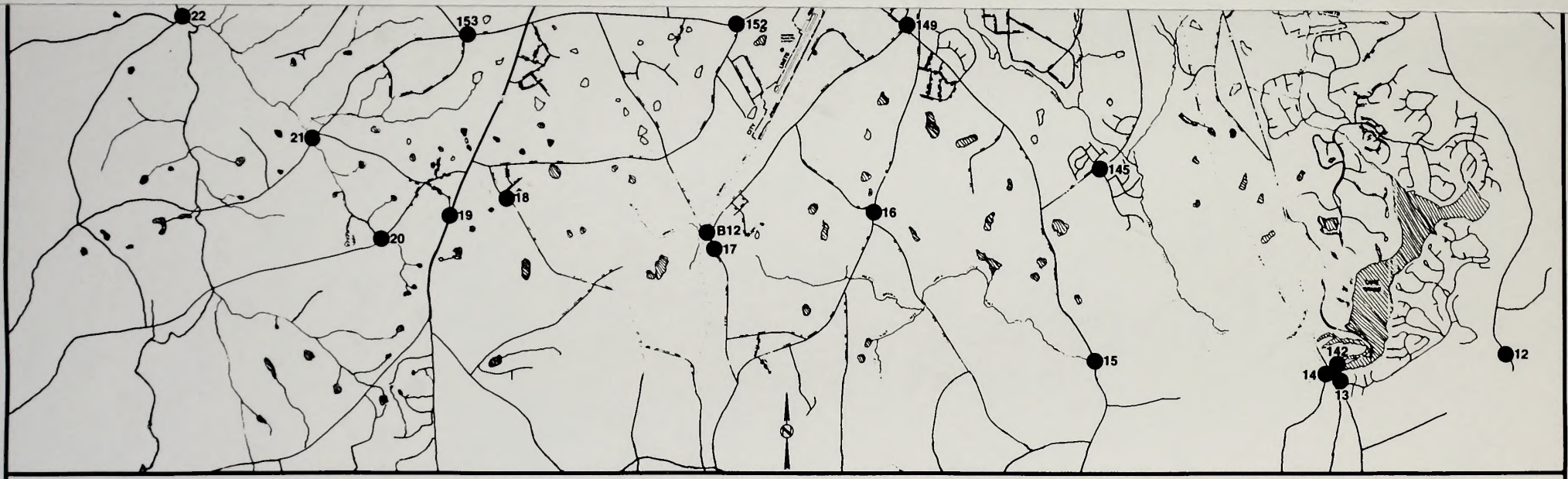
—— MODELED ROADWAY

CITY OF SANFORD
LEE COUNTY
NORTH CAROLINA

PREPARED BY THE
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH
IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 1000 2000 3000 4000
SCALE IN FEET

FIGURE 4



SANFORD 1990 BASE YEAR TRAFFIC COUNT LOCATIONS

CITY OF SANFORD

LEE COUNTY

NORTH CAROLINA

PREPARED BY THE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH

IN COOPERATION WITH

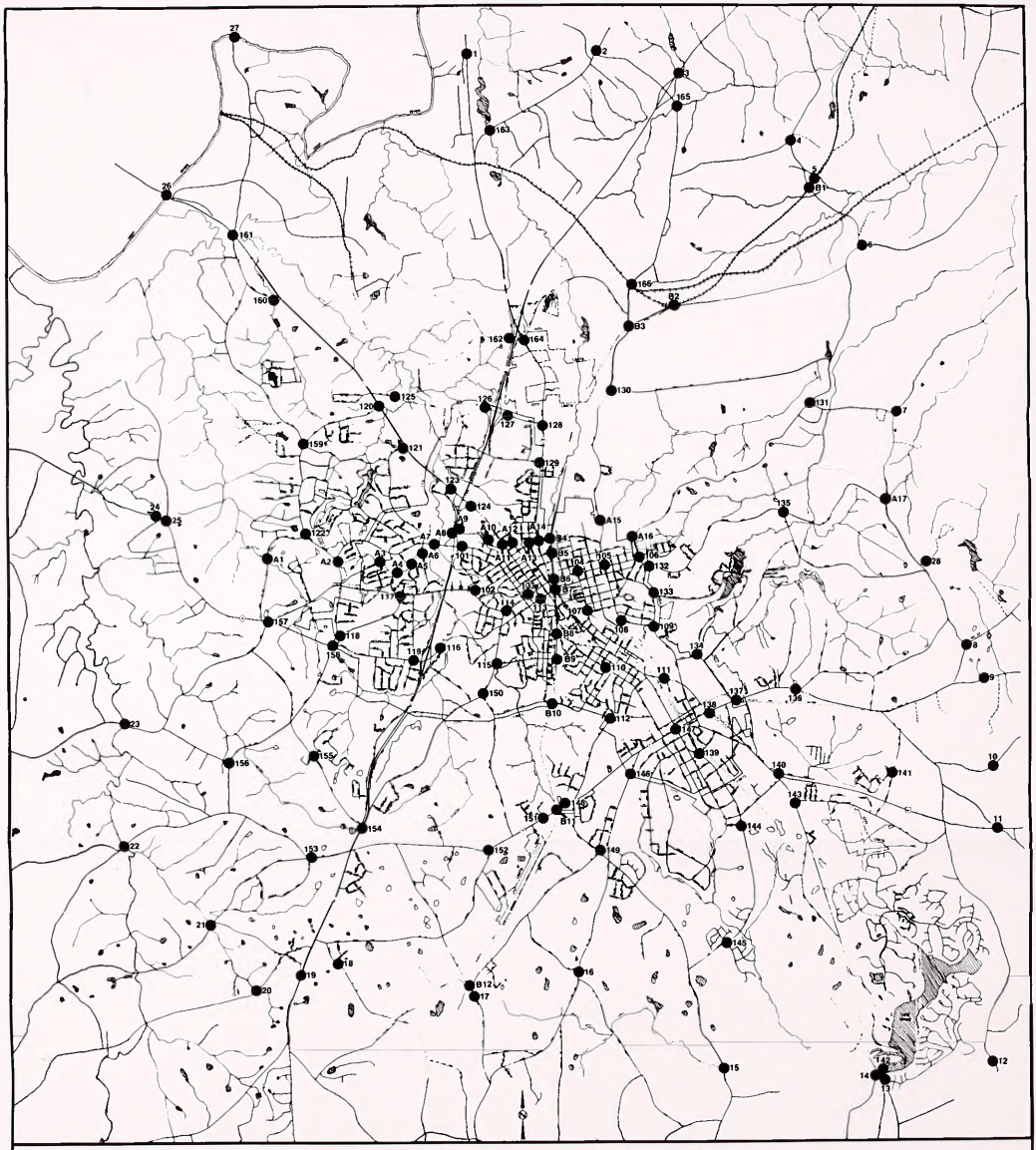
U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

0 2000 4000 6000 8000

SCALE IN FEET

FIGURE 5



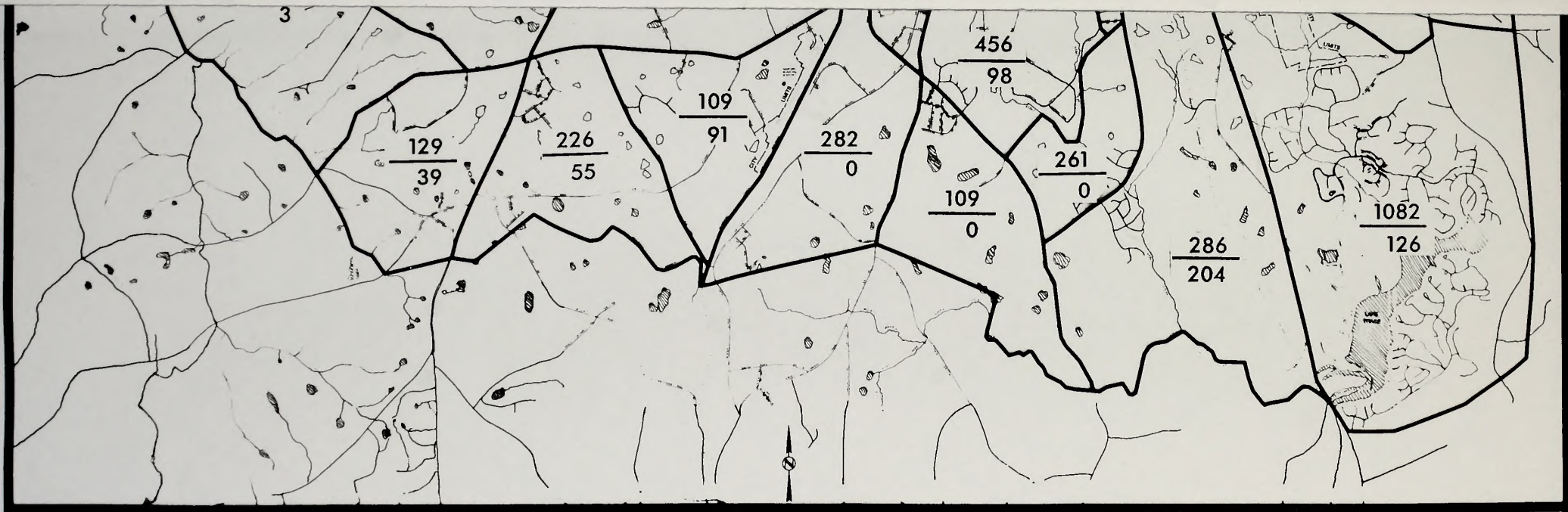
SANFORD 1990 BASE YEAR TRAFFIC COUNT LOCATIONS

CITY OF SANFORD
LEE COUNTY
NORTH CAROLINA

PREPARED BY THE
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS, STATEWIDE PLANNING BRANCH
IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 2000 4000 8000 9000
SCALE 1# FEET

FIGURE 5



SANFORD 1990 BASE YEAR
DWELLINGS AND EMPLOYMENT

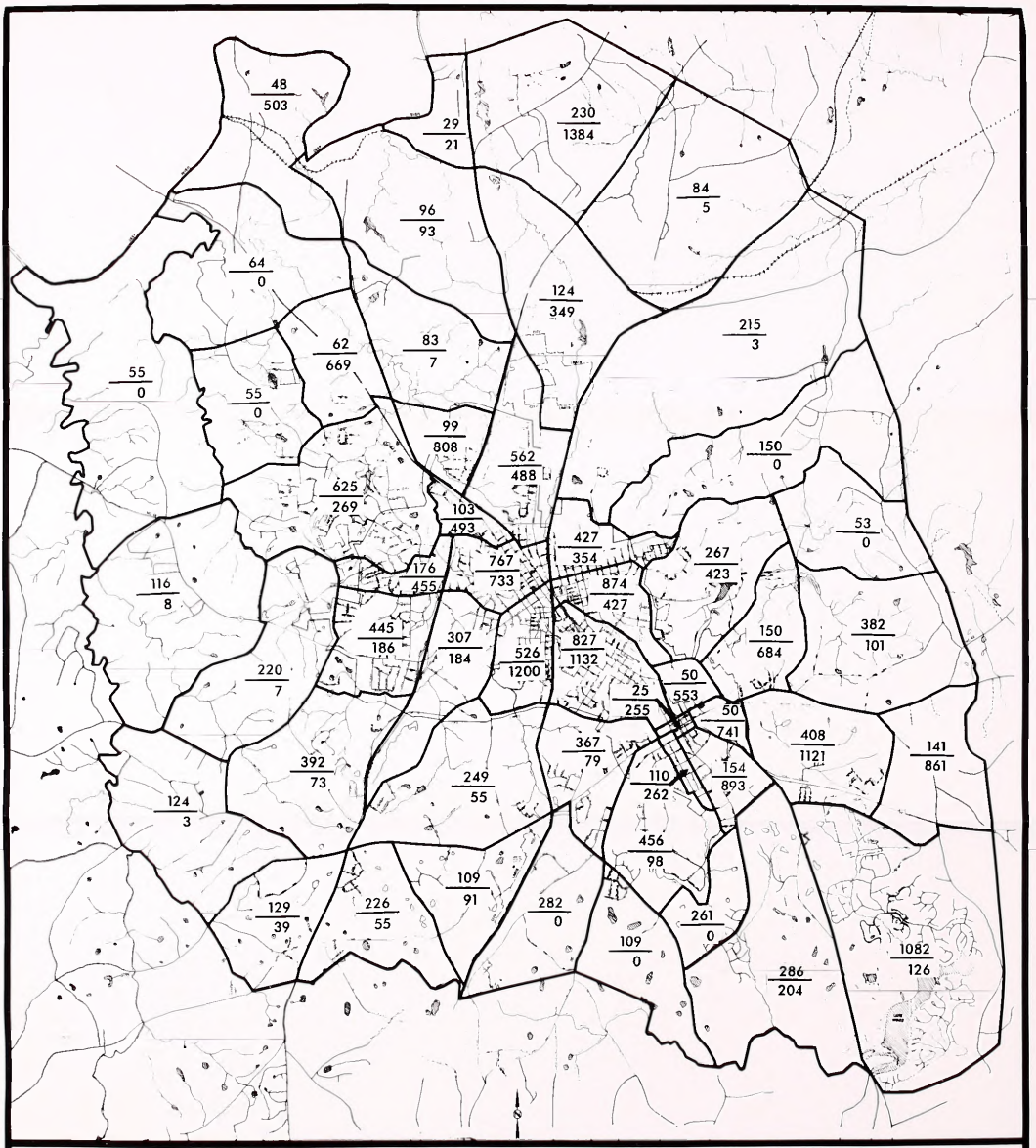
000 DWELLINGS
000 EMPLOYEES

CITY OF SANFORD
LEE COUNTY
NORTH CAROLINA

PREPARED BY THE
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH
IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 2000 4000 6000 8000
SCALE IN FEET

FIGURE 6



SANFORD 1990 BASE YEAR
DWELLINGS AND EMPLOYMENT

000 DWELLINGS
000 EMPLOYEES

CITY OF SANFORD
LEE COUNTY
NORTH CAROLINA

PREPARED BY THE
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DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH
IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

0 2000 4000 6000 8000
SCALE IN FEET

FIGURE 6

SANFORD TRIP LENGTH FREQUENCY
HOME-BASED-WORK TRIPS

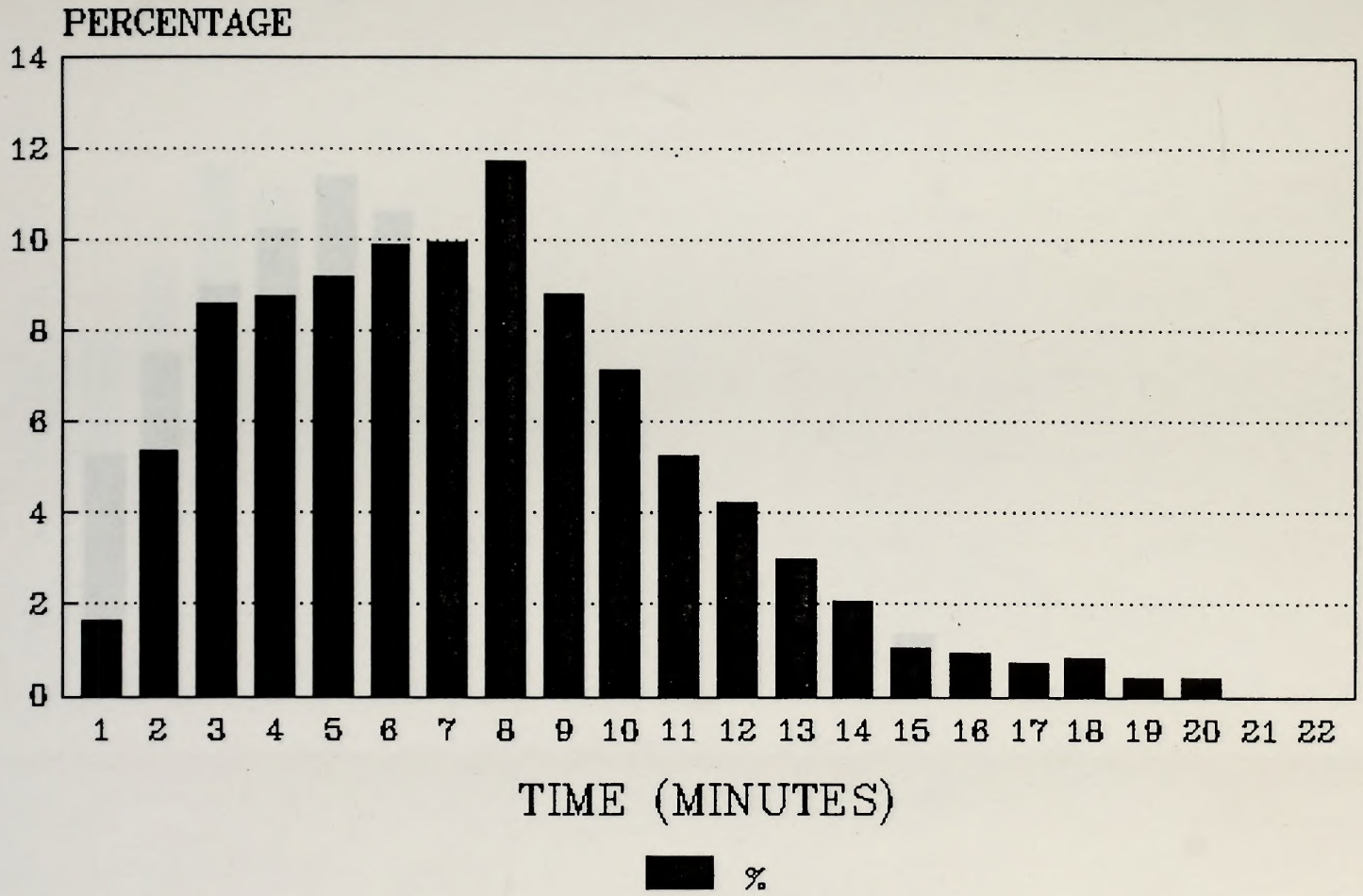


FIGURE 7

Percentage
0
2
4
6
8
10
12
14
Time (minutes)
1 to 2
2 to 3
3 to 4
4 to 5
5 to 6
6 to 7
7 to 8
8 to 9
9 to 10
10 to 11
11 to 12
12 to 13
13 to 14

SANFORD TRIP LENGTH FREQUENCY
OTHER-HOME-BASED TRIPS

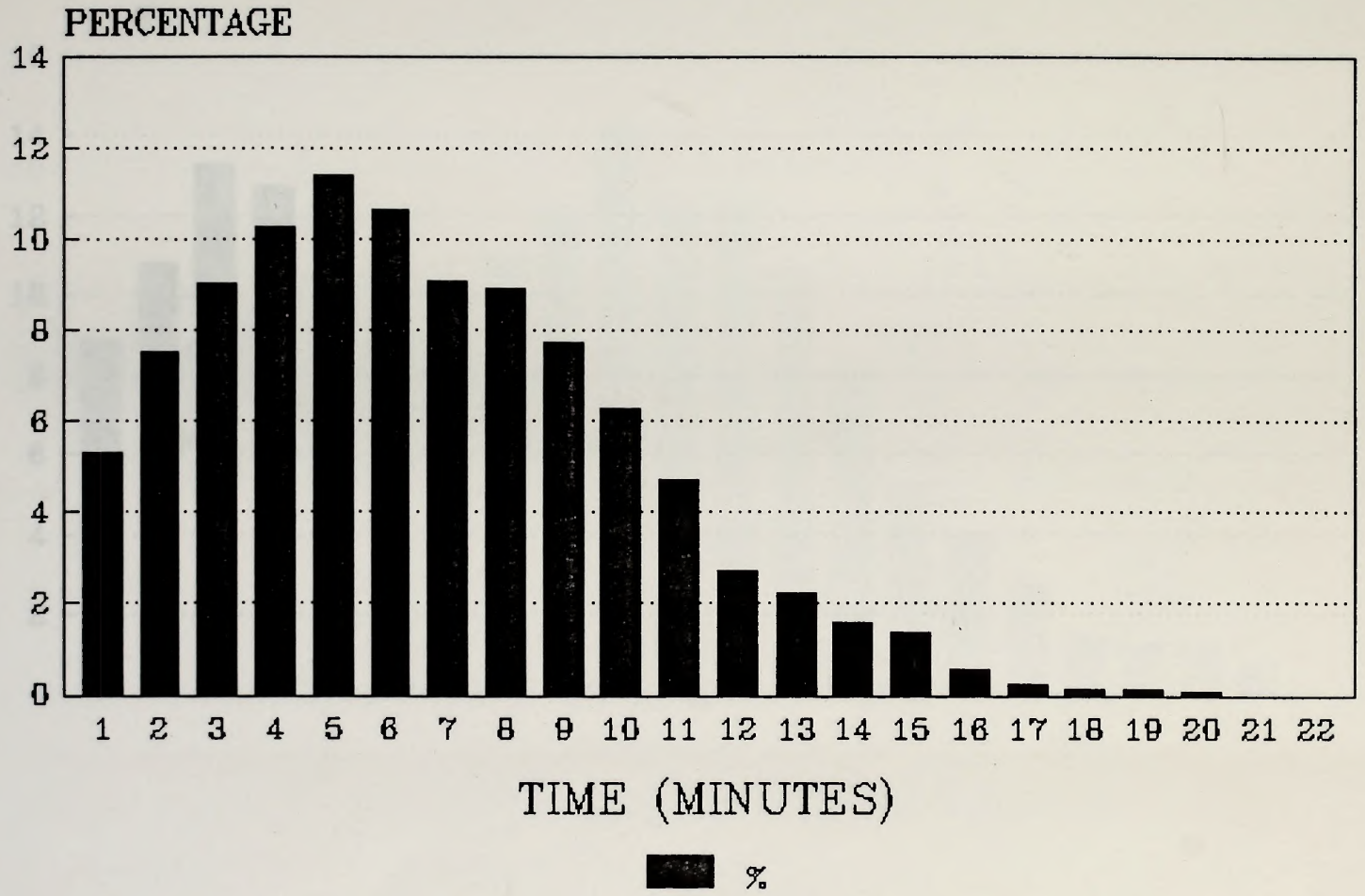


FIGURE 8

SANFORD TRIP LENGTH FREQUENCY
NON-HOME-BASED TRIPS

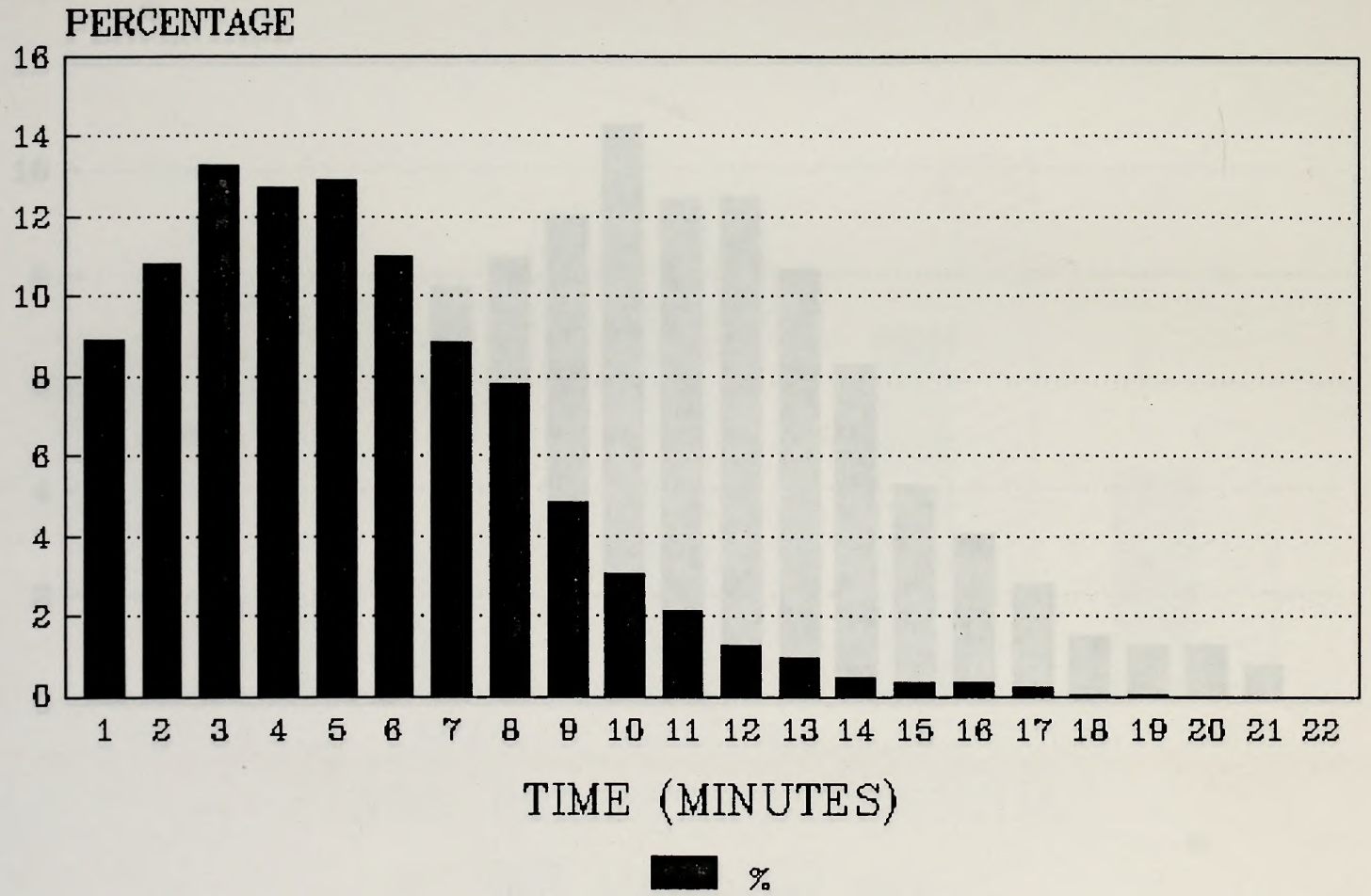
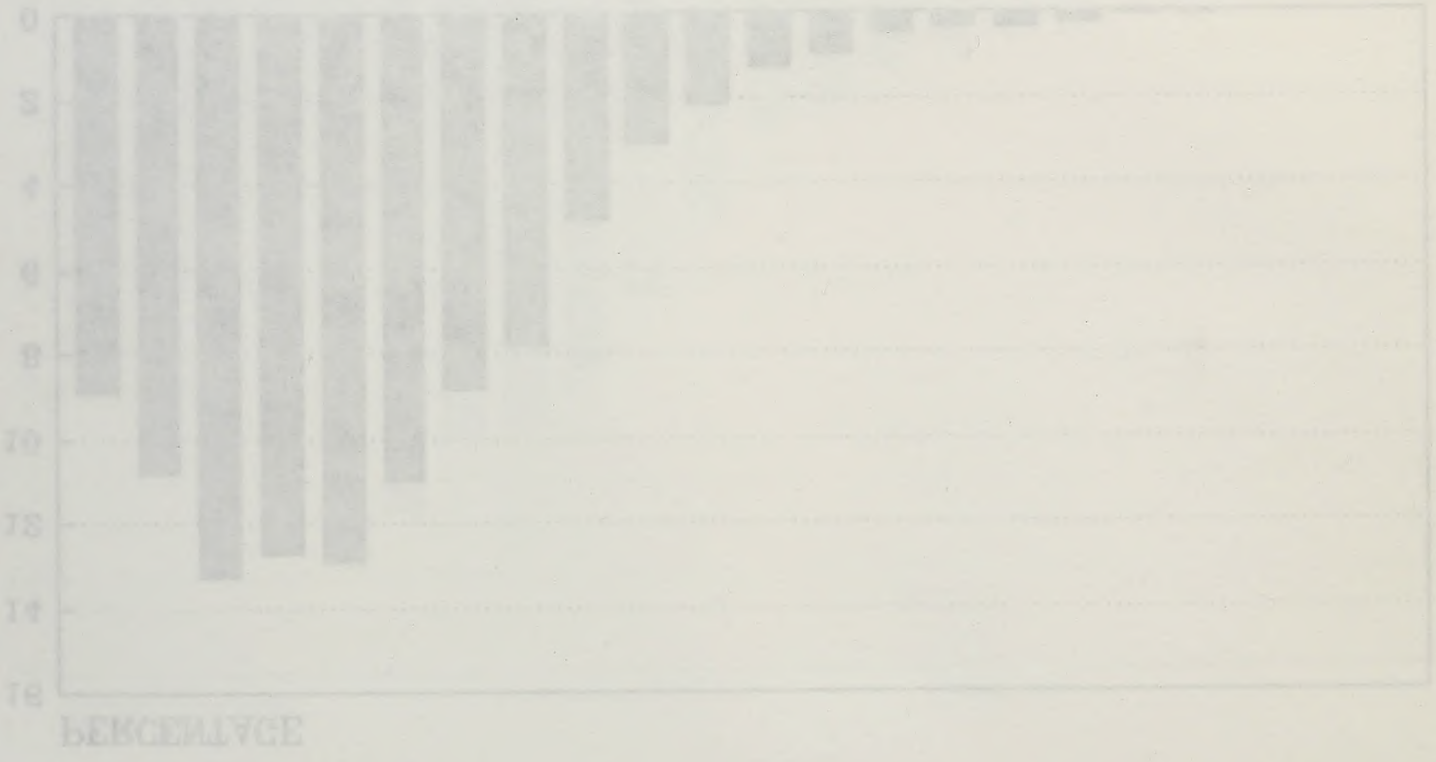


FIGURE 9


0
5
10
15
PERCENTAGE

SANFORD TRIP LENGTH FREQUENCY
EXTERNAL–INTERNAL TRIPS

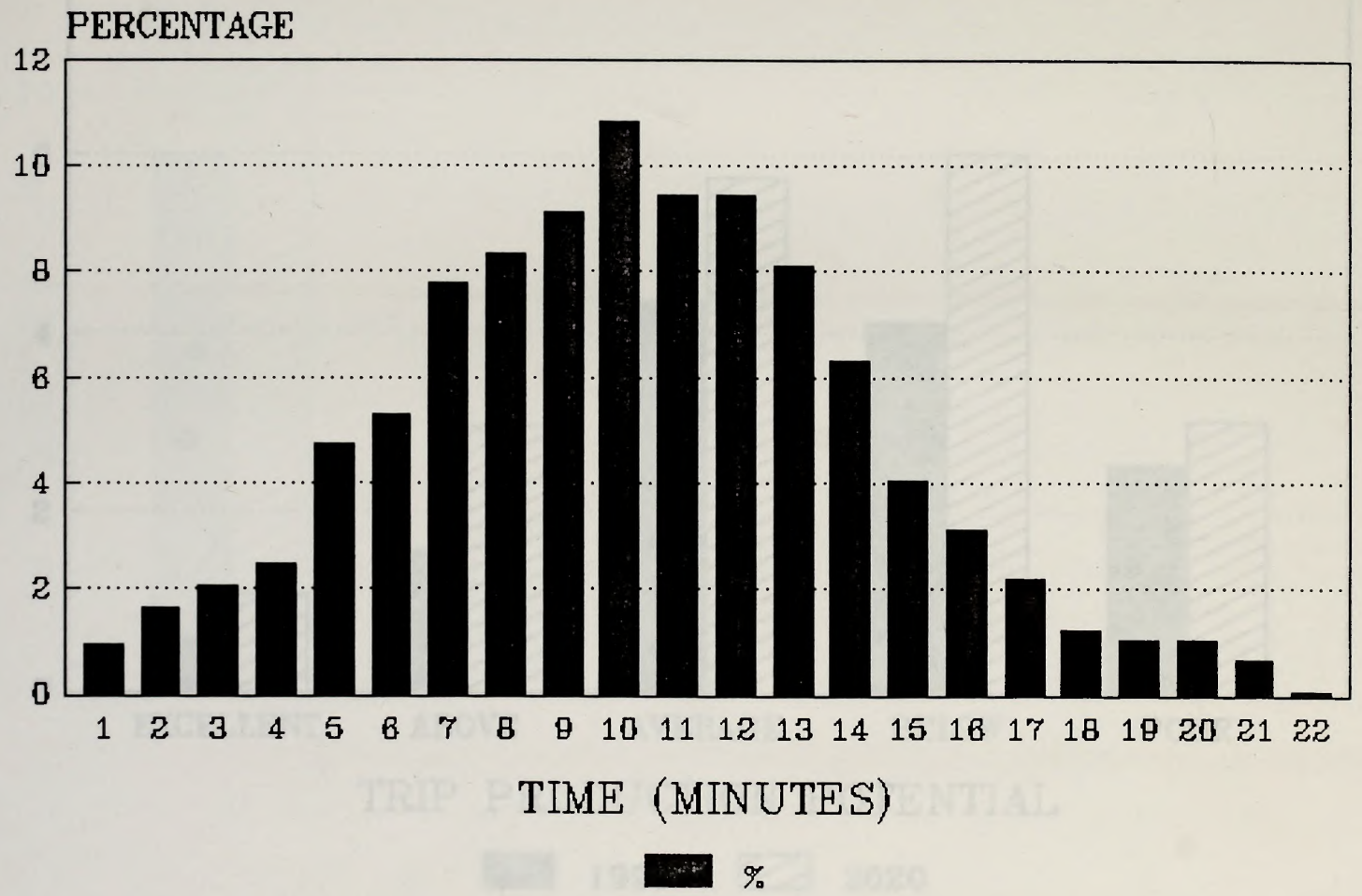


FIGURE 10

FIGURE 10

SANFORD TRIP LENGTH FREQUENCY
EXTERNAL-INTERNAL TRIPS

SANFORD DWELLING UNIT DISTRIBUTION

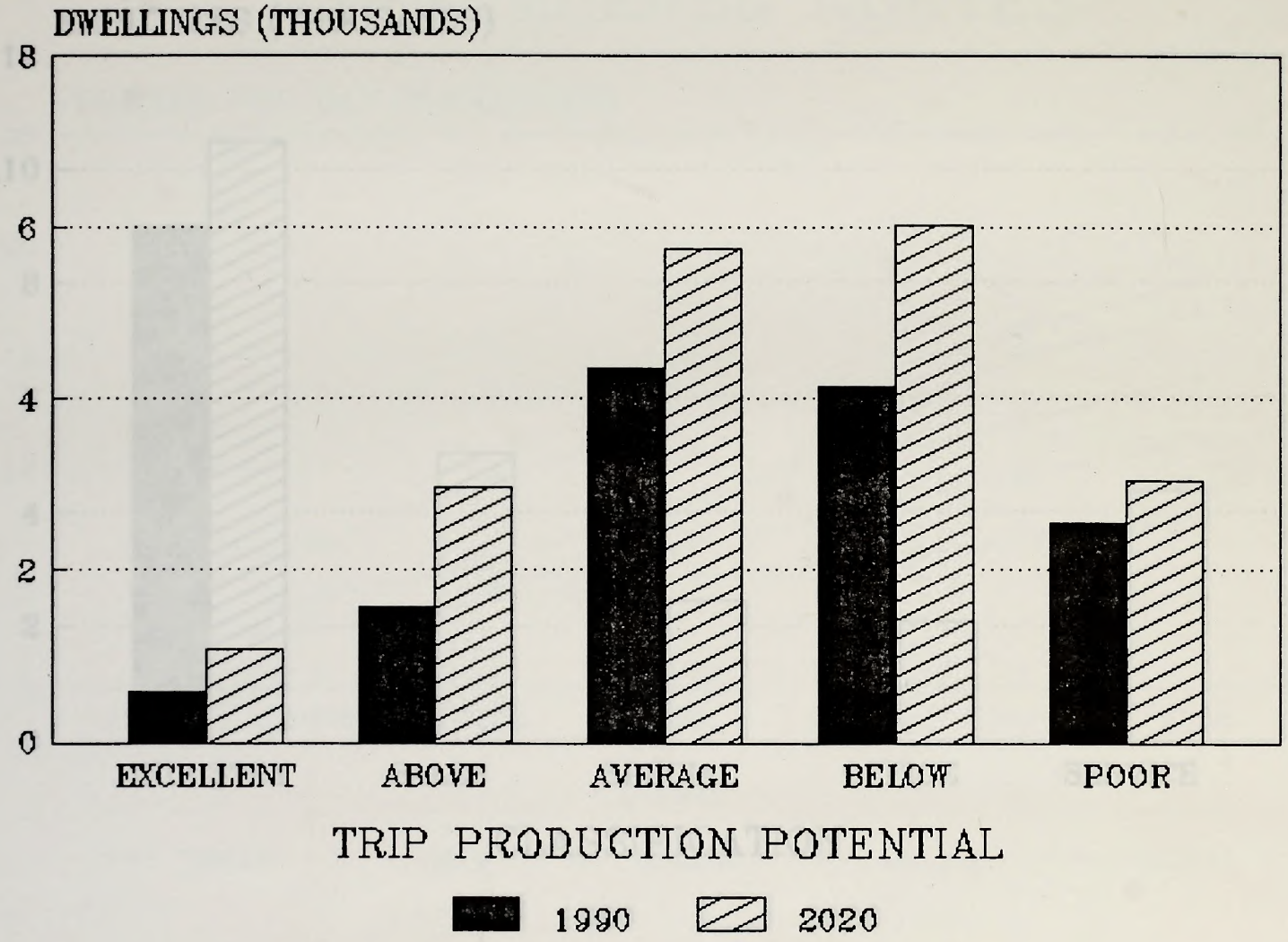


FIGURE 11

SANFORD EMPLOYMENT DISTRIBUTION

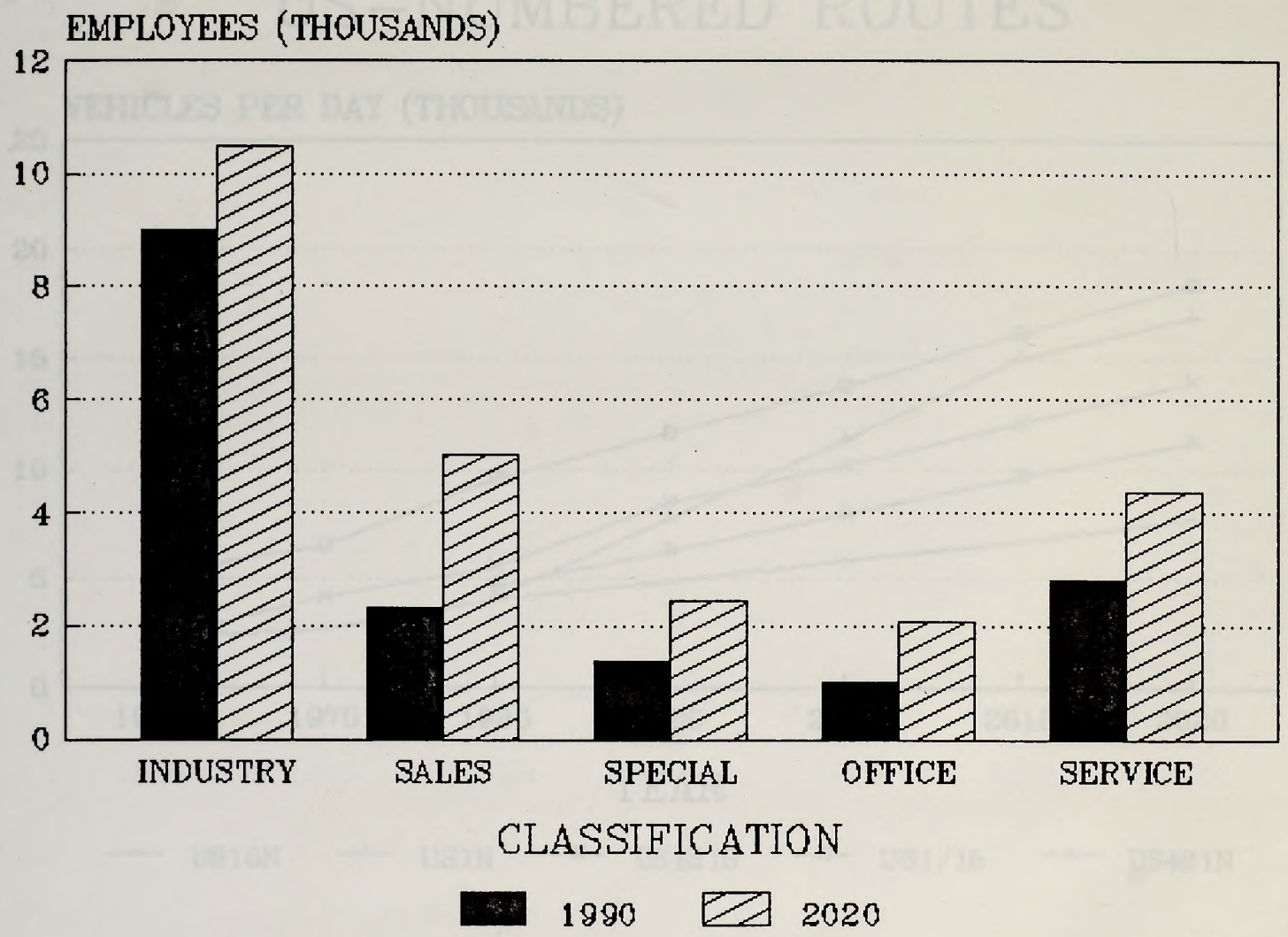


FIGURE 12

SANFORD EXTERNAL STATION TRAFFIC
US-NUMBERED ROUTES

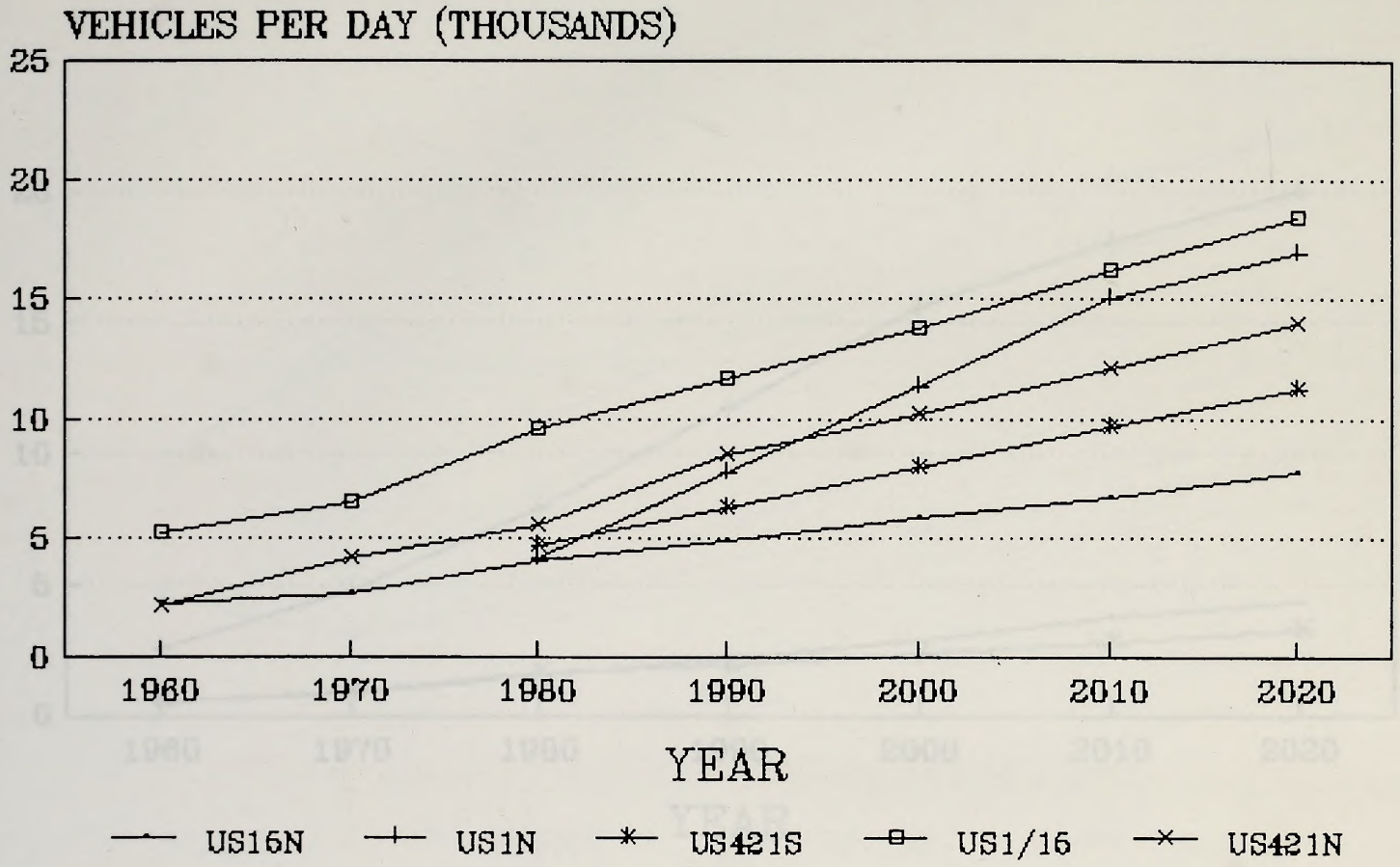


FIGURE 13

SANFORD EXTERNAL STATION TRAFFIC
NC-NUMBERED ROUTES

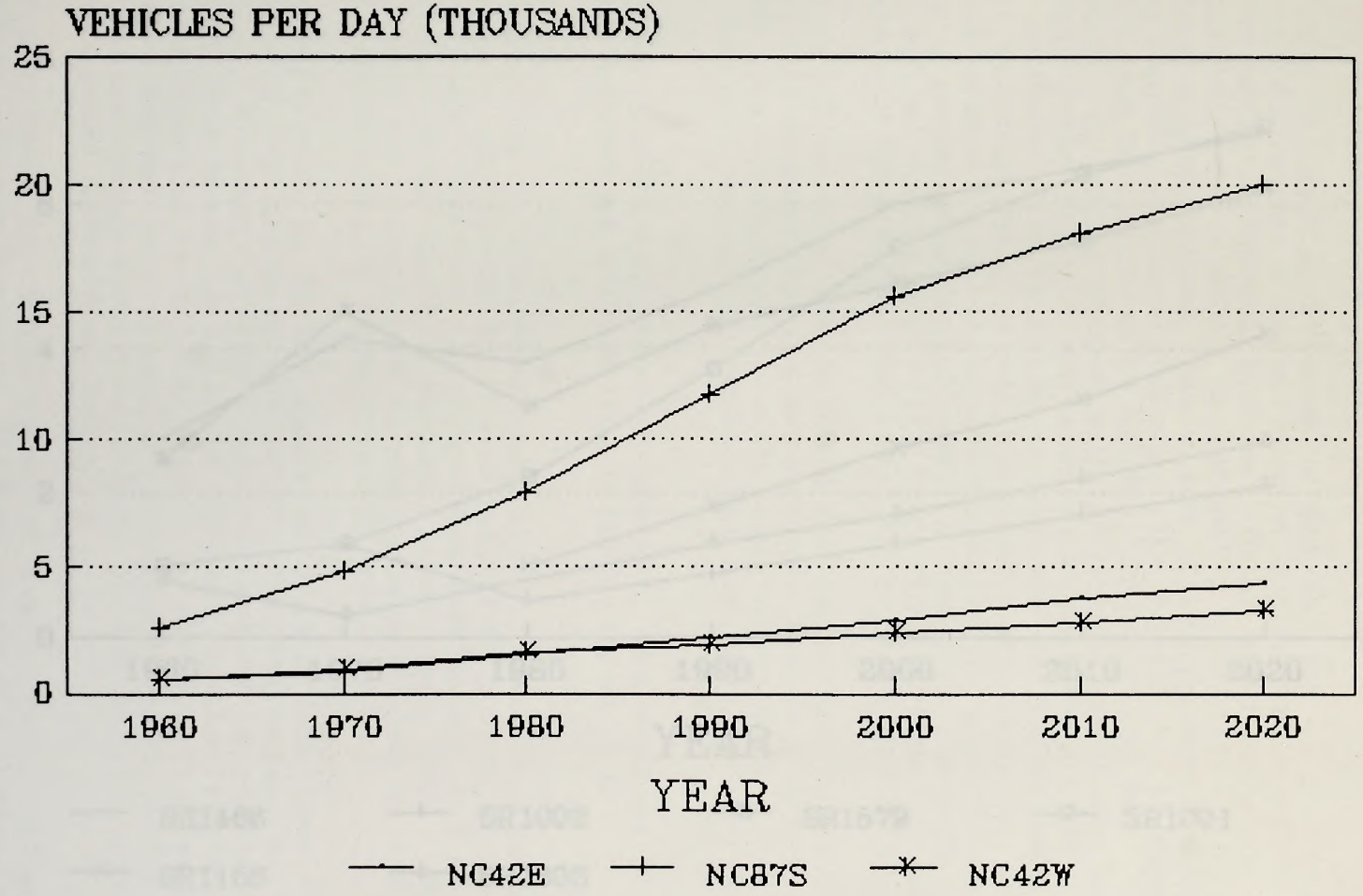


FIGURE 14

SANFORD EXTERNAL STATION TRAFFIC
SR-NUMBERED ROUTES

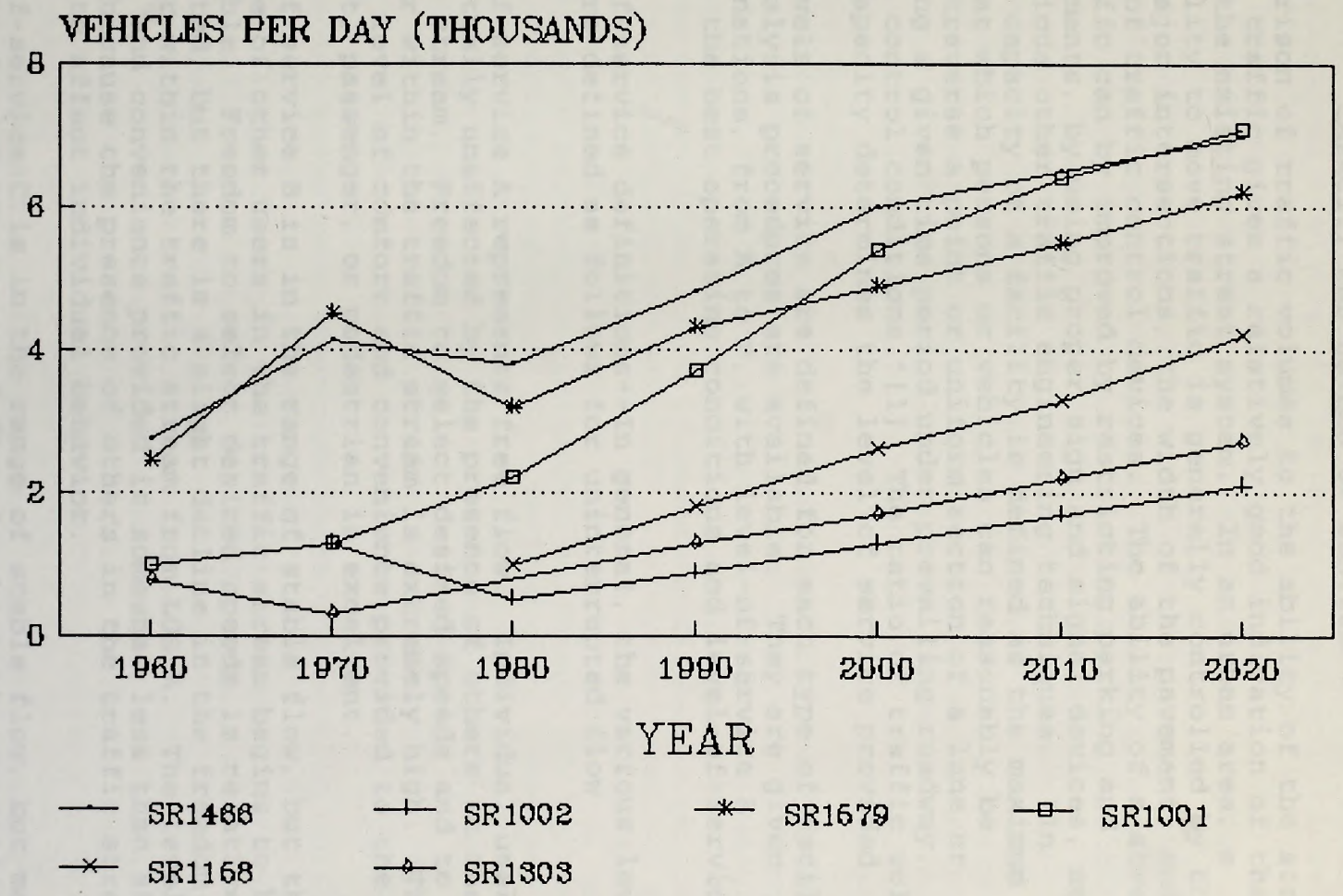
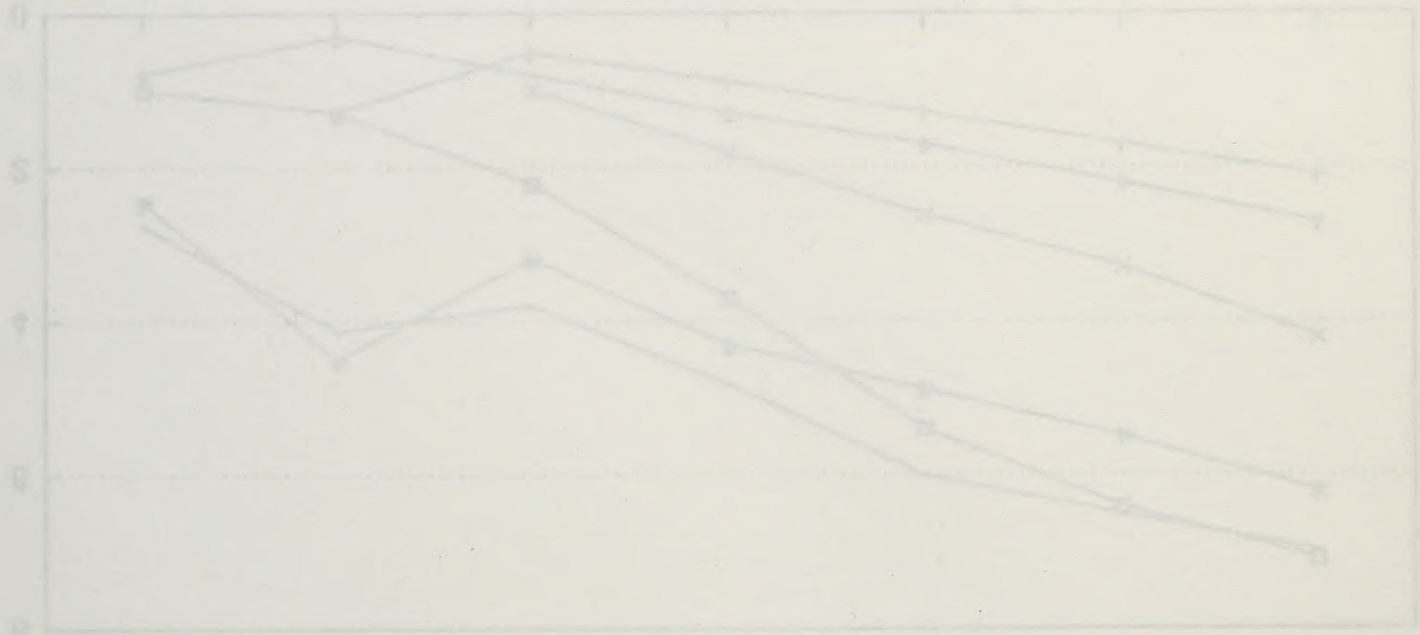


FIGURE 15 (SELECTED SRs ONLY)



SR-NUMBERED ROUTES
SANFORD EXTERNAL STATION TRAFFIC

EXISTING SYSTEM ANALYSIS

CAPACITY AND LEVELS OF SERVICE

A comparison of traffic volumes to the ability of the streets to move that traffic gives a relatively good indication of the adequacy of the existing street system. In an urban area, a street's ability to move traffic is generally controlled by the spacing of major intersections, the width of the pavement, and the utilization of traffic control devices. The ability of a street to move traffic can by improved by restricting parking and turning movements, by using proper sign and signal devices, and by applying various other traffic engineering techniques. "In general, the capacity of a facility is defined as the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions."[1] The ratio of traffic volume to roadway capacity determines the level of service provided.

"Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations, from A to F, with level-of-service A representing the best operating conditions and level-of-service F the worst.

Level-of-service definitions--In general, the various levels of service are defined as follows for uninterrupted flow facilities:

1. Level-of-service A represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent.

2. Level-of-service B is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than at LOS A, because the presence of others in the traffic stream begins to affect individual behavior.

3. Level-of-service C is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general

level of comfort and convenience declines noticeably at this level.

4. Level-of-service D represents high-density, but stable, flow. Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

5. Level-of-service E represents operation conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuvers. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.

6. Level-of-service F is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves, and these are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a cyclic fashion. Level-of-service F is used to describe the operating conditions within the queue, as well as the point of breakdown. It should be noted, however, that in many cases operating conditions of vehicles or pedestrians discharged from the queue may be quite good. Nevertheless, it is the point at which arrival flow exceeds discharge flow which causes the queue to form, and level-of-service F is an appropriate designation for such points."[2]

Various reasons may exist for traffic-carrying deficiencies on any particular street. They range from system-level problems down to project-level traffic engineering problems of operational nature. Whenever a street is deficient in its traffic-carrying ability, it is reflecting both system-level and project-level problems. The long-range solution of the deficiency must address the system-level problem simultaneously with the project-level problem. For example, a simple street widening solution to a particular congestion problem may serve only to shift the problem to another point in the planning area. A better solution may be to construct a new street which could reduce the volumes of traffic at the trouble spot and to concurrently try to maximize the efficiency of the overburdened street by employing good traffic operation measures. Many factors must be considered: land may not be available for new construction so the only alternative is to widen; economics may dictate that the cheapest solution to traffic problems (but not necessarily the best) be implemented.

Many of the factors responsible for street deficiency are listed below:

1. Travel demand that greatly exceeds the transportation system's capacity.

2. Roadway parameters which include:
   a. lane width
   b. lateral clearances
   c. shoulders
   d. auxiliary lanes, including parking lanes, speed-change lanes, turning lanes, and storage lanes
   e. surface conditions
   f. alignments
   g. grades

3. Traffic parameters which account for traffic composition, habits, and desires, and include:
   a. trucks
   b. buses
   c. lane distribution
   d. variations in traffic flow during peak hour
   e. traffic interruptions

4. Local condition parameters which represent the characteristics of the traffic demand as reflected in the traffic stream and which include:
   a. load factor
   b. peak hour factor
   c. metropolitan area population
   d. area characteristics

5. Specific traffic controls which include:
   a. marking of approach lanes
   b. traffic signal controls
   c. signal timing
   d. parking conditions
   e. one-way or two-way operations

The above list of factors affecting street capacity deficiencies is by no means exhaustive, but it serves as a basis of analysis of the deficiencies of the existing street system which will be discussed later.

EXISTING SYSTEM VOLUME/CAPACITY ANALYSIS

The discussion of the existing street system's volume-capacity ratio (v/c) is based upon the existing (1990) network capacity and the design year (2010 and 2020) traffic volumes. This analysis indicates the status of the existing street network if no improvements are made to it. The v/c analysis points out those areas of the network where capacity problems will occur. This allows the system planner to pinpoint problems and will serve

as a guide in the development of alternative plans. Each alternative plan should be designed to alleviate expected capacity problems.

Volume-capacity ratio (v/c) is a measure of the traffic volume on a street segment compared to the capacity of that segment. A v/c ratio of 1.0 represents a facility with a volume of traffic equal to its vehicle-carrying capacity. A v/c ratio of greater than 1.0 denotes a facility with a volume of traffic greater than its capacity. The more the v/c ratio exceeds 1.0, the greater is the capacity deficiency.

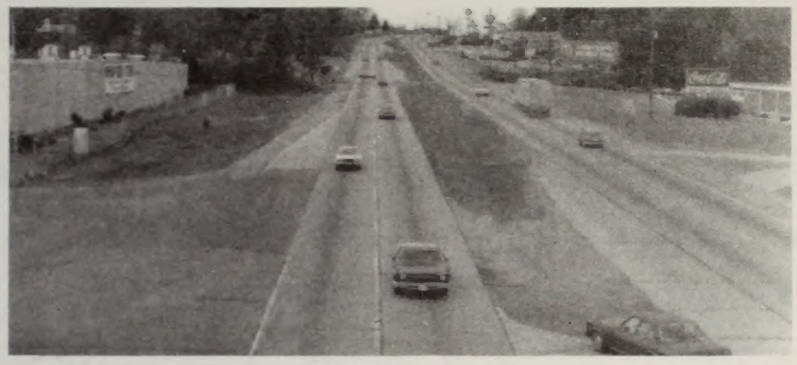
The capacity deficiencies have been illustrated using three v/c ratio groups. The first group with v/c ratios of 0.00 to 1.00 represents those facilities at or below capacity. The second group with v/c ratios of 1.01 to 1.25 represents those facilities moderately above capacity. The third group with v/c ratios of 1.26 and up represents streets seriously over capacity.

Figure 17 shows the magnitude of the capacity deficiencies that would occur if the design year traffic volumes (2020) were loaded onto the existing Sanford street network. Table 6 shows the locations with the highest number of accidents in Sanford from January 1986 through December 1990.

TABLE 6
SANFORD 1986-1990 TRAFFIC ACCIDENT SUMMARY

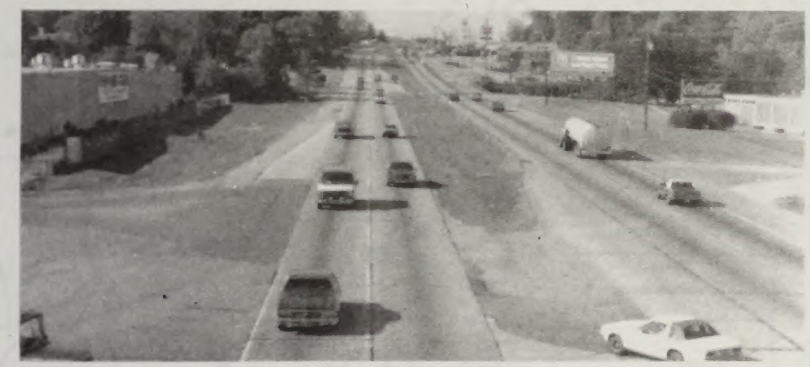
LOCATION	NUMBER
US421 Horner Boulevard at NC42/78 Main Street	91
SR1514 Bragg Street at US421 Horner Boulevard	70
US421 Horner Boulevard at SR1516 Rose Street	63
Raleigh Street at SR1133 Lee Avenue	51
US421 Horner Boulevard at Wicker Street	50
NC42/78 Main Street at SR1133 Lee Avenue	50
McIver Street at SR1415 Seventh Street	47
Jefferson Street at US421 Horner Boulevard	41

[1] Transportation Research Board, Highway Capacity Manual, Special Report 209, NRC: Washington (1985), page 1-3.
[2] Ibid.



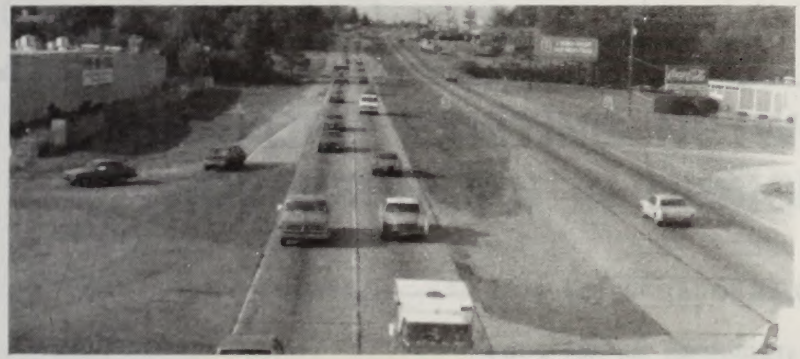
LEVEL OF SERVICE - A

LEVEL OF SERVICE - D



LEVEL OF SERVICE - B

LEVEL OF SERVICE - E

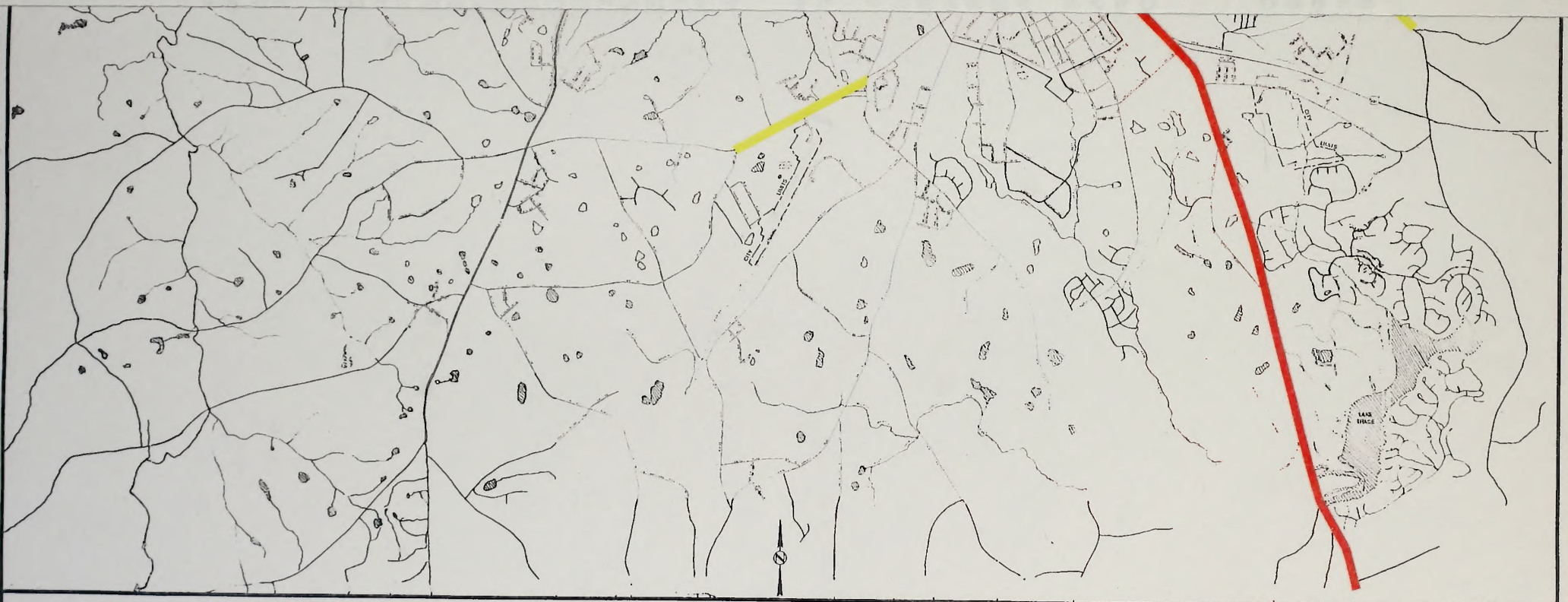


LEVEL OF SERVICE - C

LEVEL OF SERVICE - F

LEVELS OF SERVICE

FIGURE 16



SANFORD EXISTING NETWORK CAPACITY DEFICIENCIES IN DESIGN YEAR 2020

0.00 - 1.00 V/C (AT OR BELOW CAPACITY)

1.01 - 1.25 V/C (MODERATLY OVER CAPACITY)

1.26 AND UP V/C (SEVERELY OVER CAPACITY)

FIGURE 17

CITY OF SANFORD

LEE COUNTY

NORTH CAROLINA

PREPARED BY THE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH

IN COOPERATION WITH

U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

0 2000 4000 6000 8000

SCALE IN FEET

SANFORD EXISTING NETWORK CAPACITY DEFICIENCIES IN DESIGN YEAR 2020

0.00 - 1.00 V/C (AT OR BELOW CAPACITY)

1.01 - 1.25 V/C (MODERATLY OVER CAPACITY)

1.26 AND UP V/C (SEVERELY OVER CAPACITY)

CITY OF SANFORD
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0 2000 4000 6000 8000
SCALE IN FEET

FIGURE 17

ALTERNATIVE PLANS DEVELOPMENT

The work performed for this Sanford Thoroughfare Plan is an update of the work done for the 1979 Plan. The first step in the updating process was to model the elements of the 1979 Plan. The major new considerations were the upgrading and relocation of the Sanford Bypass corridor and the extension of the Southern Loop.

ALTERNATIVE 1: DO NOTHING OPTION

The "Do Nothing Option" consists of making no modifications to the street system in Sanford except for those projects which are already under construction. The "Do Nothing Option" has some major advantages which are listed below:

1. No capital investment cost.
2. No construction-related traffic disruption.
3. No noise, air, or water pollution due to construction.
4. No removal of shrubs or trees.
5. No additional land acquisition.
6. No displacement of people or businesses because of new construction.

The "Do Nothing Option" has several disadvantages which lead to severe adverse impacts upon the urban environment and are listed below:

1. Traffic volumes and congestion will increase on major streets which can cause traffic to divert onto residential streets.
2. Existing "bottleneck" situations will become worse.
3. Social, health, and safety standards will deteriorate.
4. Road use costs will increase.
5. Driving time will increase.
6. Traffic accidents will increase.
7. Traffic congestion will increase air and noise pollution.
8. Businesses will suffer increased transportation costs.
9. Emergency vehicles will have reduced mobility.
10. Retail sales will suffer as a result of increased congestion, reduced accessibility, and higher transportation costs.
11. Increased congestion will lead to higher driver and public frustration.

The "Do Nothing Option" would lead to significant traffic problems as Figure 17 in Chapter 4 shows. Access in and through downtown, along Horner Boulevard, Main Street, Lee Avenue, Broadway Road, and Deep River Road will become increasingly more difficult as the design year approaches.

ALTERNATIVE 2: NON-CONSTRUCTION MEASURES

Improving operations and altering travel demand are non-construction measures for serving future traffic demands. Operational improvements include controlling access on thoroughfares, eliminating on-street parking, utilizing one-way traffic operations, installing reversible lanes, and improving traffic signal phasing and coordination. Travel demand alteration includes increasing vehicle occupancy rates and reducing peak hour loading. These measures could be achieved by staggering work hours, carpooling, and using mass transit. Other approaches are modifying land use development patterns and restricting urban growth. The applicability of these non-construction measures for Sanford is discussed below.

Control Of Access

Capacity deficiencies result primarily from inadequate street width. Appreciable increases in capacity could be achieved by installation of barrier medians or by purchase of access rights on abutting property. However, costs to do so are prohibitive, and political ramifications are too severe, in most cases, to make this approach realistic. Access control and barrier medians are of greater importance during construction of new facilities or major widening or existing facilities, and will receive consideration in construction alternatives analysis.

Parking Removal

As mentioned previously, capacity deficiencies result primarily from inadequate street widths. All future capacities were calculated on the basis of all pavement being available for use as traffic lanes, with no parking whatsoever. Some existing street deficiencies could possibly be remediated by eliminating on-street parking, but this approach would have no effect on projected future deficiencies. On-street parking should normally be prohibited on all thoroughfares.

One-Way Streets

Sanford currently has no one-way streets. The 1979 Thoroughfare Plan did not recommend conversion to or construction of any one-way facilities. Carthage Street and Wicker Street have some potential to be converted to a one-way pair. Although projected volumes of traffic should be handled by the existing two-way flow setup on each roadway, unanticipated development or changes in traffic circulation patterns could warrant conversion to a one-way pair.

Reversible Traffic Lanes

One way to increase a street's capacity is to alter the directional flow of traffic on one or more lanes so that a large number or lanes are provided for peak hour traffic. A directional split of at least two-to-one and preferably three-to-one should exist before a modification of this type is considered. None of Sanford's streets have directional splits of this magnitude. Also, most existing streets are not appropriate for this type of alteration. Most successfully reversible lane operations take place in cities much larger than Sanford.

Traffic Signal Phasing And Coordination

The projected capacity deficiencies used in this study were determined by assuming that reasonable traffic signal phasing and coordination would be achieved. Signal phasing and coordination are particularly important along Horner Boulevard.

Transit, Ridesharing, Carpools, And Vanpools

One very certain method of decreasing traffic demand is to increase the number of persons per vehicle. However, the long-term trend has been in the opposite direction; vehicle occupancy rates across North Carolina have been moving downward over the last several decades

Transit and ridesharing are heavily influenced by a number of factors including gasoline prices, parking availability, transit headways, and publicity campaigns. The Goals and Objectives Survey conducted in Sanford during the thoroughfare planning process indicated a very low interest in public transit among local residents. With concentrations of industry along Deep River Road and Broadway Road, possibilities for ridesharing exist. However, the plausible increases in vehicle occupancy rates are insufficient to offset expected increases in population and vehicle usage.

Bicycles

The North Carolina Department of Transportation has adopted a set of goals that encourages the planning, construction, and use of bicycle facilities. Increasing the use of bicycles, while a desirable part of a transportation plan, can only play an extremely small role in the reduction of highway capacity problems. Sanford has no major areas likely to attain significant bicycle use in the future so as to serve as a meaningful transportation solution.

Altering Work Hours

Changes in business and school employee hours, so that beginning and ending times for work are staggered, can reduce travel in the peak hour and thus increase the total travel-carrying ability of the street network. A campaign to encourage employers to adopt staggered work hours could be an effective method of further reducing peak hour travel. Some inconveniences to businesses and employers will be incurred with implementation of staggered work hours. Many business operations do not lend themselves to changes in work time for their employees. Altering work hours must be carefully arranged so as not to discourage the use of any planned transit or para-transit activities.

Altering Land Use Patterns

Land use has a direct and substantial effect on transportation demand. The land use plan and the thoroughfare plan should be consistent. Sanford is currently revising the 1978 comprehensive land use plan.

Growth Restrictions

"No growth" policies can slow the growth in travel and delay the need for street improvements. However, restrictions on growth could cause stagnation of the area's economic base. This approach appears inappropriate for Sanford.

ALTERNATIVE 3: COMMITTED PROJECTS

The 1994-2000 Transportation Improvement Program (TIP) contains several projects in the Sanford area. These projects are: R-2500 US1 widening, R-2238 NC87 widening, R-2417 US421BYP construction, U-2565 Third Street extension, and U-2921 US421 widening and signal linking system. Together with the existing transportation network, these projects form the "existing plus committed" system. While these projects will make major improvements in Sanford's traffic flow, some problems will still remain. Figure 18 shows this situation.

ALTERNATIVE 4: THE 1979 PLAN

The initial modeling effort in the design year was directed towards confirming the 1979 Thoroughfare Plan. The entire recommended 1979 Plan was coded into the model and retested. Figure 19 shows the 1979 Plan. The results of this retesting indicated that the 1979 Plan did a relatively good job of addressing the needs of the design year as projected forward from 1990. Certain fine-tuning adjustments to the basic 1979 Plan are in order, however. The major change would be the shifting of the

US421 Sanford Bypass Corridor further to the east, to provide a better alignment and to minimize adverse impacts to the community. However, some deficiencies would still remain. These are identified in Figure 20.

ALTERNATIVE 5: THE RECOMMENDED PLAN

The recommended plan will meet all of Sanford's major transportation needs through the year 2020. This is the plan that was ultimately adopted by the Sanford Board of Aldermen and the North Carolina Board of Transportation. Figure 21 shows the thoroughfare plan as adopted.

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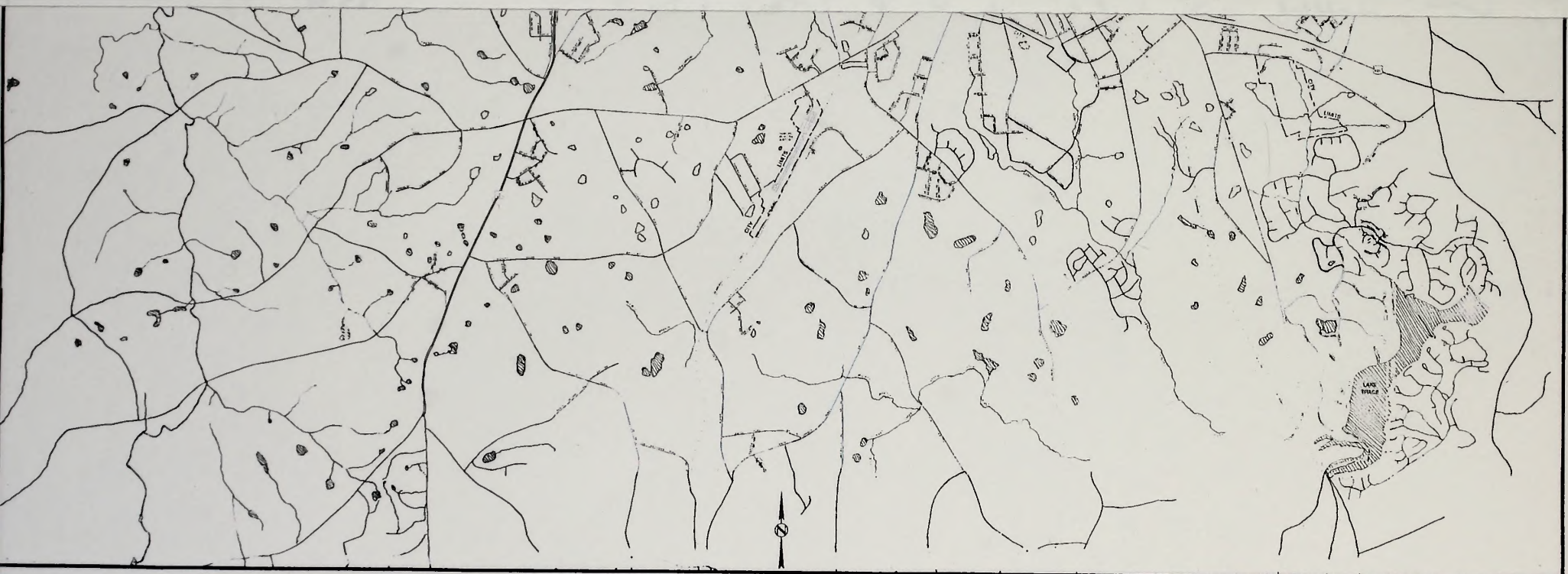

COMMITTED PROJECTS ONLY
DEFICIENCIES IN DESIGN YEAR 2020

0.00 - 1.00 V/C (AT OR BELOW CAPACITY)

1.01 - 1.25 V/C (MODERATLY OVER CAPACITY)

1.26 AND UP V/C (SEVERELY OVER CAPACITY)

CITY OF SANFORD

LEE COUNTY

NORTH CAROLINA

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IN COOPERATION WITH

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FEDERAL HIGHWAY ADMINISTRATION

0 2000 4000 6000 8000

SCALE IN FEET

FIGURE 18

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COMMITTED PROJECTS ONLY
DEFICIENCIES IN DESIGN YEAR 2020

0.00 - 1.00 V/C (AT OR BELOW CAPACITY)

1.01 - 1.25 V/C (MODERATLY OVER CAPACITY)

1.26 AND UP V/C (SEVERELY OVER CAPACITY)

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FEDERAL HIGHWAY ADMINISTRATION

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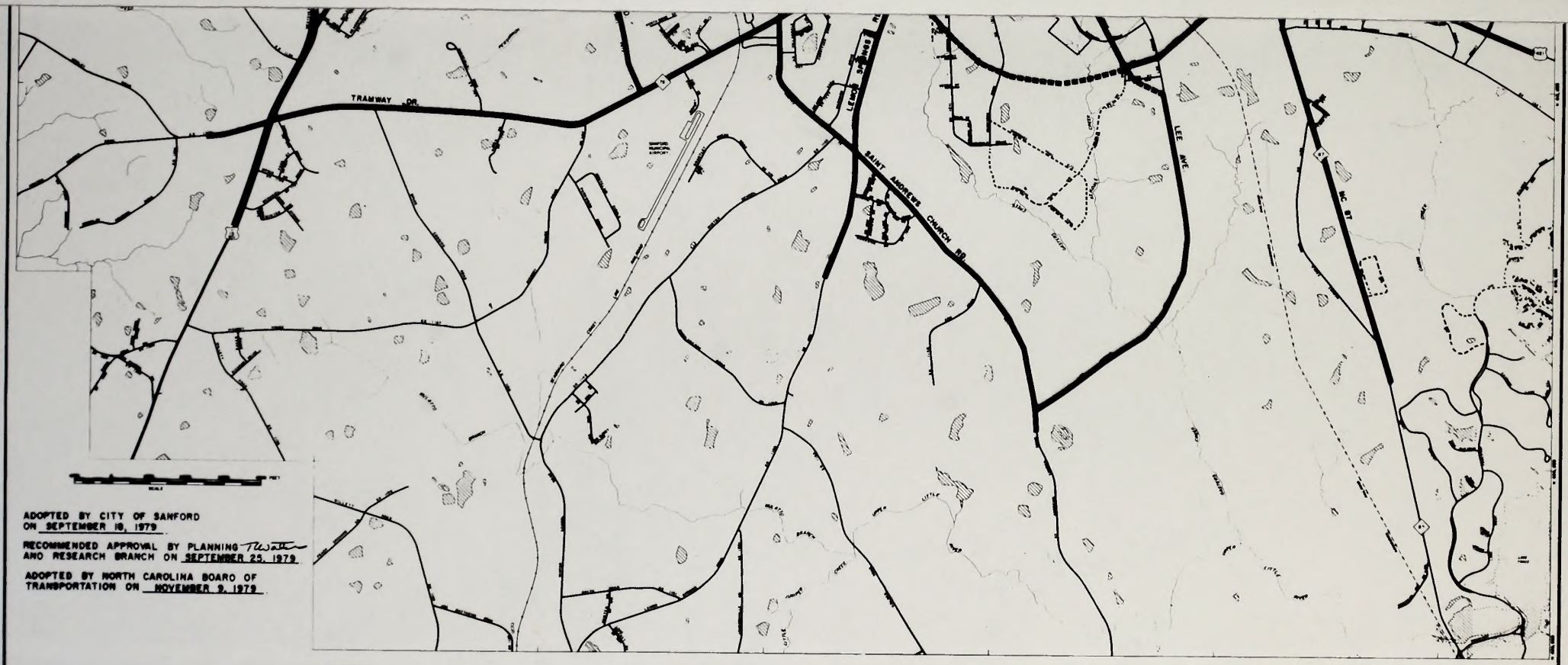
SCALE IN FEET

FIGURE 18

BIND EDGE



ADOPTED BY CITY OF SANFORD ON SEPTEMBER 10, 1979

RECOMMENDED APPROVAL BY PLANNING AND RESEARCH BRANCH ON SEPTEMBER 25, 1979

ADOPTED BY NORTH CAROLINA BOARD OF TRANSPORTATION ON NOVEMBER 9, 1979

LEGEND

	EXISTING	PROPOSED	LONG RANGE
MAJOR THOROUGHFARES			
FREEWAYS			
OTHER			
MINOR THOROUGHFARES			
INTERCHANGE			

REVISIONS		
CITY OF SANFORD	PLANNING & RESEARCH BRANCH	N.C. DEPT. OF TRANSPORTATION
[illegible]	AUG. 15 1979	SEPT. 13 1979

SANFORD

THOROUGHFARE PLAN

SEPTEMBER 10, 1979

FIGURE 19

BIND EDGE

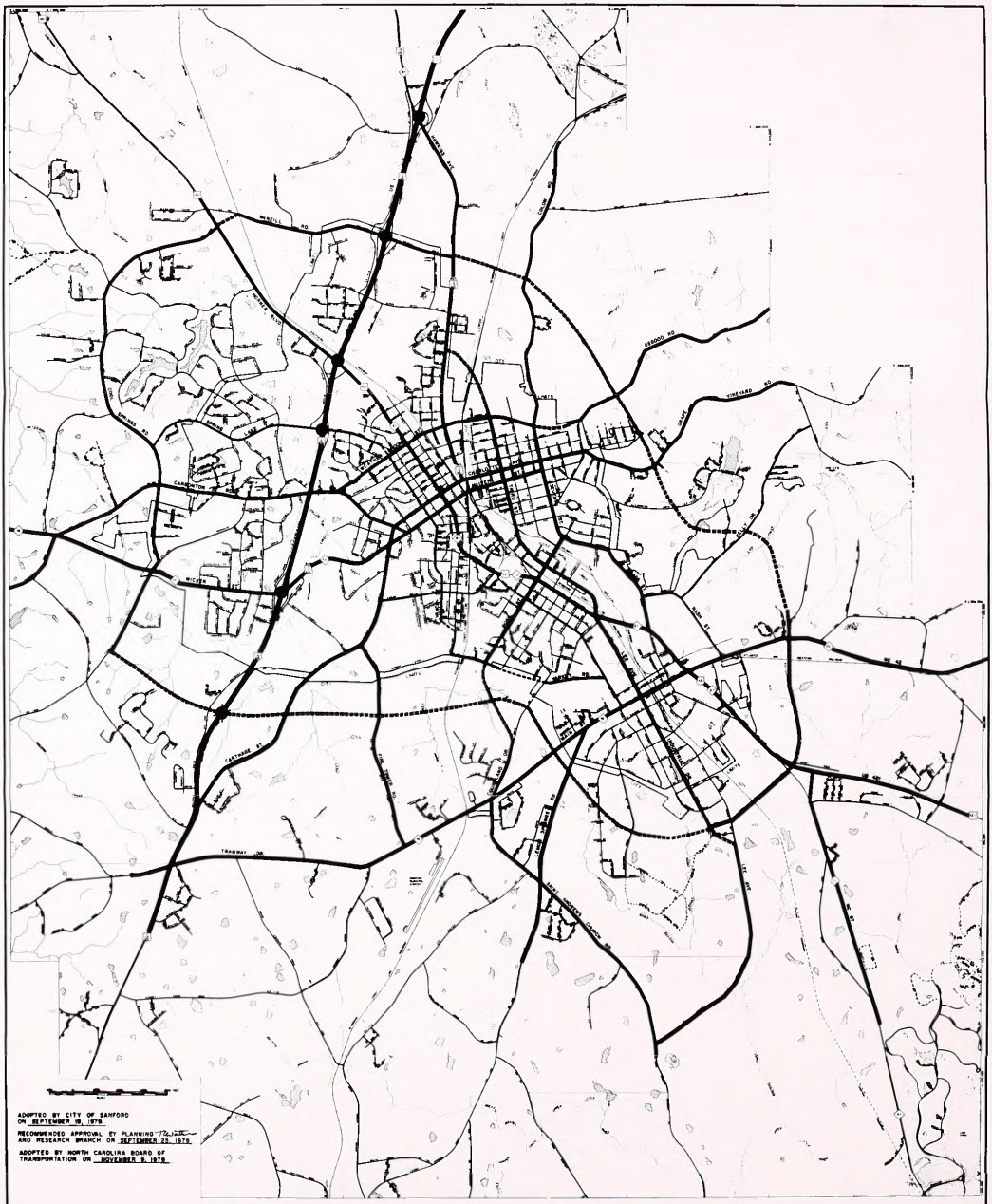
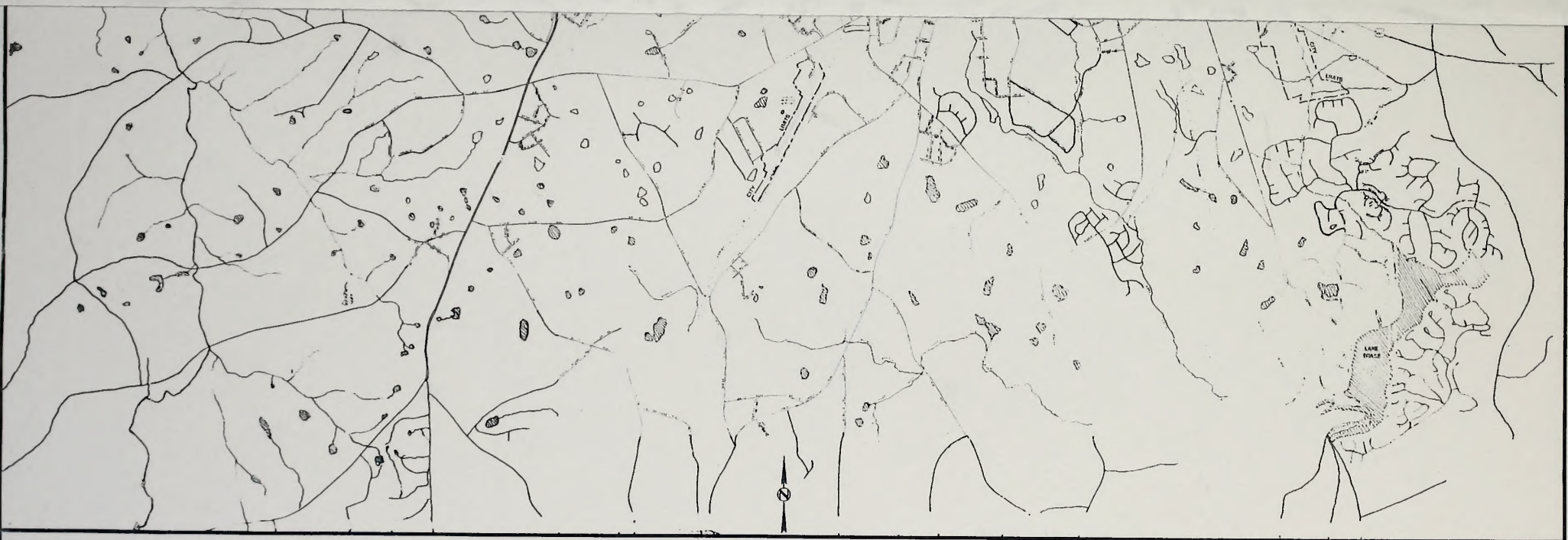


FIGURE 19

SANFORD
THOROUGHFARE PLAN

SEPTEMBER 10, 1979



SANFORD 1979 PLAN
DEFICIENCIES IN DESIGN YEAR 2020

0.00 - 1.00 V/C (AT OR BELOW CAPACITY)

1.01 - 1.25 V/C (MODERATLY OVER CAPACITY)

1.26 AND UP V/C (SEVERELY OVER CAPACITY)

CITY OF SANFORD

LEE COUNTY

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FEDERAL HIGHWAY ADMINISTRATION

0 2000 4000 6000 8000

SCALE IN FEET

FIGURE 20

SANFORD 1979 PLAN
DEFICIENCIES IN DESIGN YEAR 2020

0.00 - 1.00 V/C (AT OR BELOW CAPACITY)

1.01 - 1.25 V/C (MODERATLY OVER CAPACITY)

1.26 AND UP V/C (SEVERELY OVER CAPACITY)

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FEDERAL HIGHWAY ADMINISTRATION

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SCALE IN FEET

FIGURE 20

REVISIONS

CITY OF SANFORD	STATEWIDE PLANNING BRANCH	N. C. DEPARTMENT OF TRANSPORTATION
11/16/92	1/1/94	2/4/94

ADOPTED BY:

PUBLIC HEARING	MARCH 3, 1992
CITY OF SANFORD	APRIL 21, 1992
STATEWIDE PLANNING BRANCH	APRIL 23, 1992 M.R.
N.C. DEPARTMENT OF TRANSPORTATION	MAY 8, 1992

LEGEND

	EXISTING	PROPOSED
FREEWAY / EXPRESSWAY	▬▬	▬▬
MAJOR THOROUGHFARE	▬▬	▬▬
MINOR THOROUGHFARE	▬▬	▬▬
INTERCHANGE	●	◉
GRADE SEPARATION	○	◌

FIGURE 21

THOROUGHFARE PLAN

CITY OF SANFORD

LEE COUNTY

NORTH CAROLINA

PREPARED BY THE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH

IN COOPERATION WITH

U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

APRIL 16, 1992

0 2000 4000 6000 8000

SCALE IN FEET

REVISIONS

CITY OF SANFORD	STATEWIDE PLANNING BRANCH	N. C. DEPARTMENT OF TRANSPORTATION
11/94	11/94	11/94

ADOPTED BY:

PUBLIC HEARING	MARCH 3, 1992
CITY OF SANFORD	APRIL 21, 1992
STATEWIDE PLANNING BRANCH	APRIL 23, 1992
N.C. DEPARTMENT OF TRANSPORTATION	MAY 5, 1992

LEGEND

	EXISTING	PROPOSED
FREEWAY / EXPRESSWAY		
MAJOR THOROUGHFARE		
MINOR THOROUGHFARE		
INTERCHANGE		
GRADE SEPARATION		

FIGURE 21

THOROUGHFARE PLAN

CITY OF SANFORD

LEE COUNTY

NORTH CAROLINA

PREPARED BY THE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH

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FEDERAL HIGHWAY ADMINISTRATION

APRIL 16, 1992

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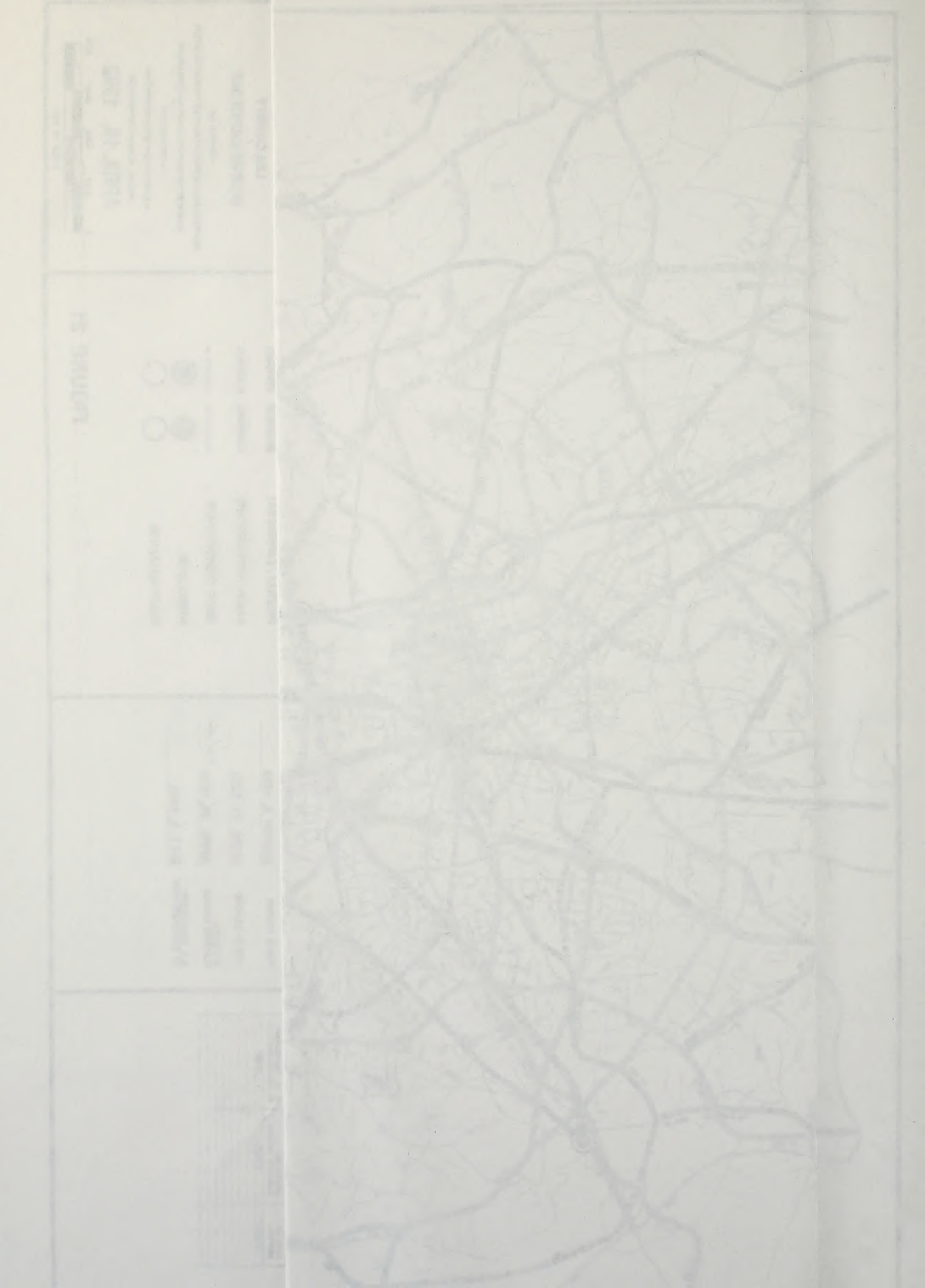

RECOMMENDATIONS

The project recommendations for specific roadways discussed here are also given in tabular form in Appendix E. Table 22 shows traffic volumes, cross sections, and right-of-way requirements.

FREEWAY THOROUGHFARES

Freeway thoroughfares are special major thoroughfares. They are distinguished by full control of access as opposed to partial or no control of access on other major thoroughfares. Freeway major thoroughfares in North Carolina are found on all Interstate-numbered routes and some US-numbered routes.

Sanford Bypass Freeway (US421BYP/NC87)

The proposed Sanford Bypass will allow through traffic to bypass the existing Horner Boulevard which is experiencing severe traffic congestion and large numbers of traffic accidents. The Bypass will also serve as the new route for NC87 in central Lee County. By 2020 this proposed facility should carry 21,000 to 24,000 vehicles per day along most of its length. A four-lane divided freeway cross section should accommodate these anticipated volumes. A collector-distributor interchange will probably be needed at its proposed junction with US1. The Sanford Bypass is part of the North Carolina Intrastate System and is listed as Project R-2417 in the Transportation Improvement Program with right-of-way acquisition scheduled for 1998. The US421BYP corridor was located so as to minimize adverse affects to many areas of social and environmental concern: Carolina Trace Subdivision, Jonesboro Elementary School, Carr Creek Subdivision, Coty Cosmetics, San Lee Park, Lee Memorial Gardens, Sanford Municipal Golf Course, Fairway Woods Subdivision, Hawkins Run Subdivision, US1-US15/US501 interchange, Forest Hills Subdivision, Big Buffalo Creek, and numerous areas of potential wetlands. The 1979 Plan corridor was studied, but found to be too potentially disruptive to existing development, particularly residential. A circuitous route around the west side of Sanford was examined, but found to be undesirable due to increased length of travel and potential adverse impacts upon existing and anticipated residential areas. The corridor as shown on the 1992 Plan is similar to that shown in the 1989 feasibility study [1] by NCDOT and avoids the many areas of concern as much as possible, but still serves the needs of the all of the citizens of North Carolina for improved regional and statewide travel service.

US1 Freeway (US1BYP/US15/US501/NC87)

US1 is a principal arterial passing through central North Carolina and connects Rockingham, Southern Pines, and Sanford to

Raleigh. Base year traffic ranges from 7,700 vehicles per day on the northern section to 14,100 north of Tramway Road. Design year traffic should reach a maximum of 30,000 vehicles per day in the vicinity of the Sanford Bypass. This existing facility is a four-lane uncontrolled access highway through the southern portion of the Sanford study area (south of Wicker Street) and a four-lane divided freeway through most of Sanford until it narrows to a two-lane freeway just south of Little Buffalo Creek. As part of a series of improvements to the North Carolina Intrastate System, it will be widened to a four-lane freeway from north of Sanford all the way up to Cary (Project R-2500); construction is scheduled to begin in 1995. Much of the right-of-way for this project already exists. This project will complement the construction of a freeway section on new location in southern Lee County and northern Moore County (Project R-210). Widening US1 to the north of Sanford towards Chatham County should not involve any major environmental or social impacts.

MAJOR THOROUGHFARES

Major thoroughfares typically serve through travel and external travel into major industrial, commercial, recreational, and institutional attractors. They may be either partial or no control of access and usually have little to no on-street parking. Major thoroughfares primarily carry intercity and intracity traffic and generally provide little land access. All US-numbered and NC-numbered routes are major thoroughfares, as well as some SR-numbered routes and municipally-maintained routes.

Bragg Street (SR1514)

Bragg Street provides mobility along the eastern edge of the densely developed area of Sanford and connects it to the Jonesboro area. It receives traffic from several nearby major generators, such as Lee Senior High School and Central Carolina Community College. Base year traffic volumes peak on the section from Horner Boulevard to Seventh Street at 9,200 vehicles per day, with a noticeable decrease north of Seventh Street. This same section should see 19,000 vehicles per day in 2020. Bragg Street is currently a four-lane curb-and-gutter facility from Horner Boulevard to McIver Street. This existing four-lane cross section should be adequate to handle anticipated daily volumes of traffic; however, a fifth lane (center turn lane) would be beneficial from a traffic engineering and safety standpoint, especially if major new commercial development occurs, so as to handle left-turn movements, although this report does not list this as a specific recommendation. Bragg Street should be extended through to Seventh Street opposite Weatherspoon Street with a multilane cross section to provide an alternative to Seventh, which suffers from poor vertical alignment, poor sight distance, and many driveways and street intersections. The extension of Bragg would utilize two blocks of the existing Eighth Street and tie into Weatherspoon

to complete a cross-town system on the north and east sides of the urban core. Several residential structures would be displaced in the vicinity of the Eighth Street and McIver Street intersection, but the area north of North Avenue is currently undeveloped. Due to the depressed topography in this immediate area, the project may require a significant fill section to tie into Weatherspoon.

Broadway Road (NC42/SR1579)

Broadway Road (Main Street) serves the major industrial area of east Sanford, as well as the East Lee Junior High School and numerous adjacent commercial enterprises, and brings in traffic from the Town of Broadway. It was also the route for US421 until the new section was constructed to the south in the 1970s. It currently carries up to 13,200 vehicles per day and should see up to 19,000 in the design year. Broadway Road should be widened from two lanes to five lanes from Nash Street to Cox Mill Road based upon this anticipated traffic volume. While not specifically recommended, due to less anticipated traffic, the section from Nash back to Horner Boulevard might also be widened to the same cross section so as to maintain cross section continuity to a major arterial, US421. The adjacent Atlantic Western Railroad track and the many commercial facilities along its route will present the possibility of significant adverse impacts during a widening project.

Bruce Coggins Road (SR1156)

Bruce Coggins Road carries traffic from Minter School Road to Tramway Road. Base year and design year traffic volumes are 900 and 3,000 vehicles per day respectively. This existing two-lane facility should be extended from Tramway Road up to US1/15/501 opposite Pendergrass Road. This extension will enable traffic moving between US1/15/501 and Tramway Road to avoid the existing intersection at Center Church Road which has roadway skew and grade differential problems. The area through which this proposed extension would pass is essentially undeveloped, except for the strip commercial facilities along US1/15/501.

Carbonton Road (NC42/SR1009)

Carbonton Road brings in traffic from the western side of the Sanford study area and also serves the extensive residential areas on the west side of US1/15/501. Traffic volumes are 3,000 vehicles per day or less; design year volumes should peak at 9,000 near Carthage Street. The 1979 Thoroughfare Plan called for Carbonton Road to be extended from Carthage Street to Wicker Street. This recommendation has been retained, but its low volume of projected future traffic (2000 vehicles per day) and its potential connection with Wicker Street below a crest vertical curve make it a very low priority. If Carthage Street and Wicker

Street were ever converted to a one-way pair, then this extension would become more important, facilitating access to Wicker Street eastbound.

Charlotte Avenue (SR1002)

Charlotte Avenue serves as the continuation of Carthage Street through the predominantly residential area of northeastern Sanford. Base year traffic volumes drop down to 3,900 vehicles per day with design year volumes predicted at 8,000. The four-lane curb and gutter section drops down to two-lane shoulder and ditch from Eleventh Street eastward. As an adjunct project to the Sanford Bypass Freeway, Charlotte Avenue should be extended from Seventeenth Street to San Lee Drive to tie into a propose interchange with the Bypass. This would improve access to the freeway from the commercial and residential areas of the east side and supersede the existing narrow and curving section of San Lee Drive to the south. A two-lane extension to the Bypass would probably not necessitate the displacement of the existing residential structures along eastern Charlotte Avenue.

Colon Road (SR1415)

Colon Road serves the industrial area of northeast Sanford. It also provides a route from US1 into Sanford for drivers seeking alternatives to Hawkins Avenue. The section north of Weatherspoon Street has the highest base year traffic (3,700 vehicles per day) with a corresponding design year volume anticipated at 6,000 vehicles per day. While the existing two-lane cross section is sufficient for future traffic volumes, the section between White Oak Drive and Riddle Road should be relocated as part of an adjunct project associated with the construction of the Sanford Bypass Freeway. This new section would pass through and interchange with the Bypass and improve access to the industrial area north of central Sanford as well as removing some of the horizontal curvature in the existing roadway.

Cotten Road (SR1403)

Cotten Road connects northwestern Lee County to US1 and US15/501. The City of Sanford's wastewater treatment plant is located off of it on Iron furnace Road. Base year traffic is 1,500 vehicles per day with design year traffic of 4,000 vehicles per day. Cotten Road should be extended as a two-lane roadway from Cumnock Road to the existing US421 opposite the proposed Tempting Church Road extension, generally following the alignment of the old section that existed prior to its deletion from the State system. This new section of Cotten will enable Cumnock and northwest area traffic to reach US421 after the lower section of Cumnock Road is lost because of the construction of the interchange between US421 and US421BYP and should carry 7,000

vehicles per day in the design year. A church and several residences are located near the existing intersection with Cumnock Road, but the remainder of the corridor is clear of development.

Cumnock Road (SR1400)

Cumnock Road carries traffic from Chatham County and from the major poultry plant down to US421. The old and narrow bridge across the Deep River has been recently replaced. Base year and design year traffic is 1,900 and 5,000 vehicles per day respectively. The existing two-lane cross section should be adequate for the design year. The southern section of Cumnock Road (south of Cotten Road) will probably be terminated to allow for construction of the US421-US421BYP interchange in the vicinity of the existing US421-Cumnock intersection.

Deep River Road (SR1466)

Deep River Road is the old US1 highway and now serves as the primary access to the Lee County Industrial Park east of US15/501. The section closest to US15/501 has the highest base year traffic (4,800 vehicles per day), and projected development in and around the industrial park should increase traffic on this section to 19,000 vehicles per day in the design year. The existing two-lane facility should be widened from US15/501 to Womack Road as study indicated that it would experience capacity problems in the design year without remedial action, due to the projected growth in employment in the vicinity of the existing industrial park. The existing roadway passes across low areas associated with Little Buffalo Creek. An alternative course of action could be extending the existing Womack Road (a non-thoroughfare) across the Carolina Western Railway track and the Little Buffalo Creek to tie into the existing Perkinson Road which intersects US15/501 north of its interchange with US1. However, this extension might affect possible wetlands along Little Buffalo Creek and also put significant traffic onto US15/501 in close proximity to its major interchange with US1, although the Perkinson Road Extension is proposed to tie into this area as well.

Farrell Road (SR1423)

Much of Farrell Road is outside the Sanford study area; however, its existing two-lane cross section should be adequate for future volumes of traffic. If the new Sanford airport is constructed as expected, Farrell Road would become an important access route to it, as well as to any associated industrial development. In that case, its current grade separation at the US1 Freeway should be converted to an interchange (most likely a diamond interchange). Spacing to the next closest interchanges would not be a problem (over 2 miles both north and south), and this route would be superior to the narrow and curving Lower

Moncure Road with its at-grade crossing of the CSX Railroad track.

Fayetteville Highway (NC87)

Fayetteville Highway connects Sanford to Fayetteville and is designated as part of the North Carolina Intrastate System. Base year traffic volumes reach 13,800 vehicles per day with design year volumes anticipated at 34,000 vehicles per day. The existing two-lane roadway is scheduled for widening to four lanes beginning in 1996 (Project R-2238) to improve access between Lee, Harnett, and Cumberland Counties. The Sanford Bypass Freeway will interchange with Fayetteville Highway in the vicinity of Harvey Faulk Road and then carry the NC87 designation northward. The northern section of the existing Fayetteville Highway between Cox Maddox Road and Horner Boulevard should be relocated slightly eastward to tie into US421 at a right angle and to avoid the Southern Loop (Wilson Road) and Horner Boulevard intersection. Another alternative for this connector is to curve it off to the west to tie into Wilson Road with a T-intersection. Development along the southern side of Wilson Road is sparse, and some traffic using this facility would desire to head westward to the industrial and commercial areas along Lee Avenue. In any case, this short connector would not be needed until the Southern Loop is constructed northward from Horner Boulevard towards Broadway Road and the existing intersection between Wilson Road and NC87 and US421 is reconfigured to accommodate it.

Hawkins Avenue (US1BUS/US15/US501/NC87)

Hawkins Avenue serves as a major commercial artery into downtown Sanford and connects this area to US1BYP/US15/US501 and to the north. It was the old US1 highway prior to construction of the new US1 freeway. It carries up to 11,900 vehicles per day in the segment north of Weatherspoon Street and should carry up to 15,000 there and up 28,000 in the segment north of US1 in 2020. Its cross section varies between two, three, and four lanes along its length. The section from Hill Avenue to Burns Drive should be widened to three-lane curb-and-gutter to improve its ability to handle left-turning vehicles accessing the commercial areas along it and to match the cross section to both the south and north. Hawkins Avenue has both commercial and residential areas between Weatherspoon Street and McNeill Road, but a three-lane cross section should not involve major disruptions to existing land uses. The 1992 Plan calls for a grade separation with the Sanford Bypass Freeway. An attempt to place an interchange here would not only involve significant loss of residential structures (Fairway Woods Subdivision) but also might induce traffic onto the roadway that might not otherwise use it, perhaps causing the need for more widening, leading to greater disruption of existing land uses.

Horner Boulevard (US421/NC42/NC87)

Horner Boulevard carries the US421 routing which connects Sanford directly to Lillington and Siler City and ultimately to Wilmington and Greensboro. This existing multilane roadway has become a major commercial corridor through Sanford. Base year traffic volumes reach 22,800 vehicles per day. It currently suffers from traffic congestion problems which would only increase without remedial action. The relief for Horner Boulevard will be the construction of the Sanford Bypass Freeway to remove through traffic and some external traffic. Even with the Bypass, however, design year traffic volumes should be 20,000 to 24,000 vehicles per day, because of the intense commercial development along it and it central path through much of Sanford. Also, Horner Boulevard is scheduled to be widened to five lanes and receive a closed-loop traffic signal system from Main Street to Fields Drive in 1996 (Project U-2921). These changes will improve traffic flow and increase safety in an area with a convergence of local and non-local traffic and a large number of turning maneuvers into the many commercial development strips on both sides of the roadway.

Industrial Drive (SR1239)

Industrial Drive serves the commercial and industrial development in the old Jonesboro area. Base year and design year traffic volumes are 2,100 and 5,000 vehicles per day respectively. Industrial Drive should be extended south of Snyder Street with a two-lane cross section over to Lee Avenue to provide better flow of traffic in from the developing residential areas along Lee Avenue to the south towards Saint Andrews Church Road.

Lee Avenue (SR1133)

As a companion to Industrial Drive, Lee Avenue serves as the north-south commercial axis through old Jonesboro. It carries up to 11,000 vehicles per day of base year traffic and should carry up to 14,000 in the design year. The segments from Industrial Drive to Main Street and from Main Street to Horner Boulevard should be widened to five lanes to improve traffic flow through this intensely developed commercial area. The segment from Main to Horner will probably involve disruption to some existing land uses due to their close proximity to the roadway.

Lemon Springs Road (SR1001)

Lemon Springs Road connects the residential areas south of Sanford to Tramway Road and to the commercial district in old Jonesboro. The section from Saint Andrews Church Road to Main Street has base year and design year traffic volumes of 3,400 and 13,000 vehicles per day respectively. This existing two-lane roadway should be widened to a multilane section to serve the

future traffic from the developing residential areas along it as well as to the south.

Lower Moncure Road (SR1002)

Lower Moncure Road brings traffic from the northeast part of the study area into eastern Sanford. Base year traffic is 1,600 vehicles per day with a design year estimate of 4,000 vehicles per day. This very old two-lane roadway should not require any widening from a capacity standpoint. However, if traffic increases significantly because of the planned new airport or associated industrial development, then straightening of its many horizontal curves would be very desirable, particularly south of Wallace Branch Creek. The roadway should also be extended from its turn into Eleventh Street westward to the proposed Bragg Street extension to Seventh Street. This project is similar to the Weatherspoon Street extension shown on the 1979 Plan.

Main Street (NC42/NC78)

Main Street (Tramway/Broadway Road) passes through the middle of the old Jonesboro central business district and connects US1/US15/US501 and Horner Boulevard. It carries up to 12,200 vehicles per day in the base year with 14,000 anticipated in the design year. The two-lane cross section should be widened to a multilane section from the Southern Loop to Lee Avenue, which may be difficult due to the close proximity of some structures to the existing roadway. Widening from Lee Avenue through to Horner Boulevard should not be required if the Southern Loop and the eastern Harkey Road extension are constructed and parking is prohibited on Main Street. Widening the street between Lee Avenue and Dalrymple Street would be extremely expensive and disruptive because of the many business structures located just a few feet away from the existing curb.

Northwest Connector Road

The proposed Northwest Connector Road would link the Cumnock-Cotten Road area to the industrial and commercial areas along US15/US501. This proposed two-lane roadway would start at Cotten Road south of Iron Furnace Road (which leads to the City's sewage treatment plant) and head eastward to US15/501 north of Northview Drive and carry 7,000 vehicles per day in the design year.

Pendergrass Road (SR1334)

Pendergrass Road carries traffic from the residential areas of southwest Sanford to US1/US15/US501. The existing two-lane segment from US1/US15/US501 to Franklin Drive carried 1,700 vehicles per day in 1990 with 3,000 vehicles per day expected in

2020. The segment of Pendergrass Road from west of Franklin Drive to Steel Bridge Road will become part of the proposed Southern Loop Road.

Perkinson Road

The proposed Perkinson Road will become an important access route for development in northwest Sanford. It will link the residential areas of Cool Springs Road to the industrial areas of US421 and US15/US501 and to the Sanford Bypass Freeway and should carry 4,000 vehicles per day in the design year. This corridor has been delineated so as to miss the Glenwood Village Subdivision, the existing industrial development on US421, and the Stonybrook Subdivision, and to cross the Norfolk Southern Railroad track and Big Buffalo Creek at right angles, while still leaving room for an interchange with the Sanford Bypass.

Pumping Station Road (SR1510)

Pumping Station Road carries traffic from San Lee Drive and Poplar Springs Church Road to San Lee Park, a major recreational area in Sanford. With base year traffic at 500 vehicles per day and design year traffic at 4,000 vehicles per day, the current two-lane cross section should be adequate. The proposed extension from San Lee Drive to Colon Road will provide opportunities for development in this area and will improve access to the US1 interchange at Colon Road from the eastern side of the study area. It should carry 9,000 to 11,000 vehicles per day in the design year. The segment from San Lee Drive to Lower Moncure Road will provide access to the Sanford Bypass Freeway for motorists coming down Lower Moncure Road, which will not have an interchange with the Freeway. The additional extension from Lower Moncure to Colon will provide improved local mobility if this area develops. The Pumping Station Road extension will have to cross the Carolina Northwestern Railway track and pass through a low-lying area full of old clay pits in the vicinity of Colon. It will tie into Colon Road using the existing Birchard Road (SR1421).

Rose Street (SR1119/SR1516)

Rose Street provides the primary connection across Woodland Avenue, Horner Boulevard, Third Street, Seventh Street, and the center of Sanford. Base year traffic is 4,500 vehicles per day with 10,000 anticipated for the design year. It should be extended from Crest Street down to Garden Street and then also down to Courtland Drive (intersecting the Southern Loop Road) and should carry 6,000 and 5,000 vehicles per day, respectively, in the design year.

San Lee Drive (SR1509)

San Lee Drive provides access for the areas between Poplar Springs Church Road and eastern Sanford, including San Lee Park. It has base year and design year traffic volumes of 1,400 and 5,000 vehicles per day respectively. A section of this existing two-lane roadway will be realigned to accept the extension of Charlotte Avenue coming eastward to its interchange with the Sanford Bypass Freeway. This interchange is the only one planned between Broadway Road and Colon Road and will therefore serve a large land area for purposes of access to the Bypass.

Southern Loop Road

The Southern Loop Road will provide greatly improved mobility around southern Sanford. It will connect the southwestern, south central, and southeastern residential areas of Sanford to US1/US15/US501 and US421, and it will improve access to Central Carolina Community College and the Broadway Road industrial area and relieve congestion in the Bragg Street and Nash Street area. This facility was proposed on the 1979 Plan, but has been extended farther to the west to intersect Carbonton Road and farther to the east to loop around Jonesboro and tie back into Bragg Street opposite Seventh Street. This eastern addition roughly follows the corridor of the old concept of the Sanford Bypass (US421BYP) on the 1979 Plan. The Southern Loop Road will incorporate Wilson Road and part of Pendergrass Road. Upon completion, it could be designated as the new routing for NC42, instead of the current Broadway-Horner-Carthage-Wicker-Carbonton zigzag. Part of the Loop has been programed (but not funded) as Project U-2566 with two-lane construction on multilane right-of-way. The roadway should be built as a partially controlled access facility in the sections on new location so as to maintain the high level of service envisioned for this major facility. Estimated design year traffic volumes range from 4,000 vehicles per day on the western-most side to 12,000 vehicles per day on the Wilson Road section. The south side of Wilson Road is currently lightly developed, and the City of Sanford should concentrate its right-of-way protection efforts for the project on this key segment.

Tempting Church Road (SR1322)

Tempting Church Road serves light residential development north of Carbonton Road. This existing two-lane facility should be extended northward to cross Patterson Creek and tie into US421 opposite the Cotten Road extension. This new section of roadway will facilitate residential development in the northwest quadrant of Lee County and should carry 6,000 vehicles per day in the design year if development occurs as anticipated.

Third Street (SR1515)

Third Street serves as an alternative to Horner Boulevard for traffic moving north-south within Sanford. Base year traffic is 4,300 vehicles per day and design year traffic is 6,000 vehicles per day. Third Street should be extended with a multilane cross section north from Weatherspoon Street past the Municipal Building and around to Hawkins Avenue opposite Stroud Street. This section should carry 7,000 vehicles per day in the design year and will improve local mobility and complete the alternative corridor to Horner Boulevard. It will reduce potential heavier volumes of traffic on Weatherspoon Street. Third Street extension is shown as Project U-2565 in the Transportation Improvement Program with right-of-way acquisition scheduled to begin in 1998.

Weatherspoon Street (SR1560)

Weatherspoon Street serves as cross-town roadway on the north side of Sanford's central core. Base year traffic volumes reach 8,500 vehicles per day with 10,000 vehicles per day anticipated for the design year. Weatherspoon Street should be extended westward from Underwood Street to Carbonton Road to complete this route, as was also shown on the 1979 Plan. This extension would have to cross over an unnamed creek and pass through an established residential area.

Wicker Street (US1BUS/NC42)

Wicker Street carries traffic in from the west side of Sanford to the central business district. Base year traffic volumes range from 2,800 to 9,100 vehicles per day. If the design year traffic of 15,000 vehicles per day between Carthage Street and Horner Boulevard occurs as anticipated, on-street parking should be eliminated and the existing 48 feet of pavement be restriped for four lanes. This expansion in capacity can be accomplished within the existing right-of-way, with no loss of adjacent commercial structures.

Wilson Road (SR1136/SR1240)

Wilson Road connects the industrial and commercial areas along Lee Avenue and Industrial Drive to the Horner Boulevard. Base year and design year traffic volumes are 3,900 and 13,000 vehicles per day respectively. This existing two-lane roadway will become part of the Southern Loop Road. Since the Loop is proposed for multilane right-of-way (with initial two-lane construction), right-of-way protection for Wilson Road is extremely important. Considerably less development has occurred on its southern side, and acquisition of additional right-of-way should concentrate here. Wilson Road is a good candidate for protection via a setback ordinance. It is also one of two

existing sections of the Southern Loop Road (the other is a part of Pendergrass Road) and is a key component of the Loop concept.

Other Major Thoroughfares

The following roadways are identified as major thoroughfares on the 1992 Thoroughfare Plan but should not require any significant improvements beyond increasing all existing lane widths to the standard 12 feet: Avents Ferry Road (NC42), Carthage Street (US1BUS/NC42/SR1237), Center Church Road (SR1303), Cool Springs Road (SR1325/SR1326), Courtland Drive (SR1122), Fire Tower Road (SR1152), Franklin Drive (SR1332), Henley Road (SR1305), Lillington Highway (US421), McIver Street, Minter School Road (SR1149), Poplar Springs Church Road (SR1537), Post Office Road (SR1418), Saint Andrews Church Road (SR1146), Seventh Street (SR1415), Steel Bridge Road (SR1318), and Tramway Road (NC78).

MINOR THOROUGHFARES

Minor thoroughfares typically serve internal travel within the urban area. They normally have no control of access and often have on-street parking. Minor thoroughfares primarily carry only intracity traffic and generally provide significant land access, as well as carrying traffic already on local streets to major thoroughfares. Minor thoroughfares are normally SR-numbered routes and municipally-maintained routes.

Beechtree Drive [New]

The relocated Beechtree Drive will replace the existing Beechtree Drive (SR1448) roadway between Canterbury Road and McNeill Road, which will be lost during construction of the interchange between US1/US15/US501 and the Sanford Bypass Freeway. The new roadway will run beside the US1/15/501 right-of-way and then loop around the Forest Hills Subdivision towards McNeill Road to partially replace the loss of local access caused by the cutting of McNeill during construction of the US1/US15/US501-US421BYP interchange. It will also enable traffic heading to McNeill Road to avoid using Canterbury Drive and Piedmont Drive through the subdivision. Projected design year traffic will be 3,000 vehicles per day, and a two-lane roadway should be adequate.

Burns Drive (SR1406)

Burns Drive currently connects the residential area west of US1BYP/US15/US501 to Hawkins Avenue. This existing two-lane facility should be extended from Hawkins Avenue to Colon Road. It will serve to connect these two major thoroughfares and the industrial area between them. It will also allow traffic on Hawkins Avenue to access the Sanford Bypass Freeway via the Colon

Road interchange, since Hawkins Avenue will only have a grade separation. 3,000 vehicles per day should utilize this proposed section of Burns in the design year. An at-grade crossing of the CSX Railroad track should be adequate as anticipated future volumes of traffic are low. This particularly corridor was selected so as to avoid the existing industrial buildings along Hawkins Avenue, to cross the railroad track at a location with acceptable grade and sight-distance characteristics, and to avoid the clay pits along Colon Road.

Canterbury Road

Canterbury Road serves as the extension of Burns Drive to move traffic from the residential areas west of US1BYP/US15/US501 to Hawkins Avenue. The existing two-lane roadway should be extended to the west to intersect US421 opposite Wilkins Drive. This will complete a minor thoroughfare inner loop for this northwest section of Sanford and provide access to the proposed park along the Big Buffalo Creek. This proposed section should carry 6,000 vehicles per day in the design year. This project will not cause dislocation of any businesses or residences due to the currently undeveloped nature of the selected corridor. Right-of-way protection for the corridor is a high priority because any development along or near Big Buffalo Creek could cause it to become infeasible due to a lack of alternative corridors.

Fields Drive (SR1107)

Fields Drive connects the commercial and health care development along Carthage Street to Horner Boulevard. Its base year and design year traffic volumes are 5,500 and 7,000 vehicles per day respectively. Fields Drive should be extended as a three-lane section from Horner Boulevard to Third Street to allow eastbound traffic to use Third instead of Horner. Design year traffic on this segment should be 6,000 vehicles per day. Woodland Avenue currently intersects Horner Boulevard at the same location as Fields Drive, creating a very poor intersection. Woodland Avenue should be terminated before Horner to allow for a safe, right-angled intersection between Horner and the extended Fields Drive. Woodland Avenue traffic already has the Evergreen Street route for access to Fields Drive, so traffic flow will be maintained through the area.

Harkey Road

Harkey Road serves residential traffic in the area between Rose Street and Woodland Avenue. A two-lane cross section should be extended to the west to Garden Street, as shown on the 1979 Plan, and a three-lane cross section should also be extended to the east to Nash Street. This double extension will create an alternative to the Main Street corridor. The Harkey Road

extensions will be on new location and affect very few properties, making this route more attractive for earlier development than the widening of Main Street, which is severely constrained by existing commercial uses. The western extension of Harkey Road should carry 3,000 vehicles per day in the design year, and the eastern extension, 6,000 vehicles per day, likewise.

McNeill Road (SR1405)

McNeill Road was identified as a major thoroughfare on the 1979 Plan as part of US421BYP, but with the shifting of the Sanford Bypass Freeway to the north and east, it has been downgraded to a minor thoroughfare as its primary purpose is now to connect traffic to the US421 Highway. It will be cut in two at US1BYP/US15/US501 to accommodate the Sanford Bypass Freeway interchange. Base year traffic is 2,100 vehicles per day, and design year traffic should be 3,000 vehicles per day. As shown on the 1979 Plan, the western section should be relocated to intersect US421 opposite Cool Springs Road, but given the reduced importance of McNeill Road and the difficulties posed by the railroad track, the creek, and the existing commercial structures, this relocation is of very low priority. The current intersection ties into US421 opposite Glenwood Drive with adequate grades and sight distances, again indicating a low priority for the project.

Vance Street (SR1226)

Vance Street serves north-south traffic through mainly residential areas of central Sanford. This roadway should be extended to the south to Washington Avenue and also to the north to Spring Lane which would divert some of the traffic from the five-way intersection of Spring Lane, Weatherspoon Street, Vance Street, and Gulf Street known as "five points." This proposed extension is short in length but may be made difficult by the potentially historic property on Spring Lane, which would be affected. Design year traffic volumes range from 2,000 to 6,000 vehicles per day.

Other Minor Thoroughfares

The following roadways are identified as minor thoroughfares on the 1992 Thoroughfare Plan but should not require any significant improvements beyond increasing all existing lane widths to the standard 12 feet: Courtland Drive (SR1122), Evergreen Street, Garden Street (SR1117), Hill Avenue, Kelly Drive (SR1521), Lick Creek Road (SR1508), Nash Street (SR1519), Old Carbonton Road (SR1329), Riddle Road (SR1416), Spring Lane (SR1100), Washington Avenue (SR1108), Wilkins Drive (SR1328), and Woodland Avenue.

[1] Division of Highways, Feasibility Study For US421-NC87 Sanford Bypass, Project R-2417, NCDOT: Raleigh (1989)

TABLE 7
SANFORD BENEFITS, COSTS, AND IMPACTS ESTIMATES

PROJECT	BENEFITS dollars	COSTS dollars	ECONOM IMPACT	ENVIRO IMPACT
Beechtree Drive (0.7 miles) (R)	1,289,000	R 335,000 C 1,051,000	+0.1	+0.1 -0.0
Bragg Street (0.2 miles) (E)	1,953,000	R 93,000 C 591,000	+0.2	+0.0 -0.1
Broadway Road (1.8 miles) (W)	18,478,000	R 68,000 C 3,347,000	+1.0	+0.1 -0.0
Bruce Coggins Rd (0.5 miles) (E)	1,858,000	R 72,000 C 739,000	+0.2	+0.0 -0.0
Burns Drive (0.7 miles) (E)	24,682,000	R 17,000 C 1,051,000	+1.0	+0.1 -0.0
Canterbury Road (0.3 miles) (E)	32,490,000	R 6,000 C 455,000	+0.2	+0.2 -0.3
Carbonton Road (0.1 miles) (E)	1,747,000	R 50,000 C 114,000	+0.1	+0.0 -0.0
Charlotte Avenue (1.0 miles) (E)	14,898,000	R 36,000 C 1,477,000	+0.4	+0.2 -0.2
Colon Road (0.8 miles) (R)	4,038,000	R 17,000 C 1,193,000	+0.3	+0.1 -0.0
Cotten Road (0.8 miles) (E)	11,855,000	R 20,000 C 1,222,000	+0.3	+0.1 -0.0
Deep River Road (0.9 miles) (W)	5,018,000	R 12,000 C 1,619,000	+0.8	+0.1 -0.0
Fayetteville North (0.3 miles) (R)	4,314,000	R 31,000 C 426,000	+0.2	+0.0 -0.0
Fayetteville South (3.4 miles) (W)	125,446,000	R 198,000 C 7,568,000	+0.7	+0.1 -0.1
Fields Drive (0.3 miles) (E)	10,023,000	R 326,000 C 398,000	+0.6	+0.1 -0.1
Harkey Road East (0.9 miles) (E)	25,607,000	R 372,000 C 1,307,000	+0.5	+0.1 -0.0
Harkey Road West (0.3 miles) (E)	2,564,000	R 7,000 C 511,000	+0.3	+0.1 -0.1

TABLE 7
SANFORD BENEFITS, COSTS, AND IMPACTS ESTIMATES

PROJECT	BENEFITS dollars	COSTS dollars	ECONOM IMPACT	ENVIRO IMPACT
Hawkins Avenue (0.7 miles) (W)	3,704,000	R 2,000 C 682,000	+0.5	+0.1 -0.1
Horner Boulevard (1.7 miles) (W)	5,228,000	R 124,000 C 1,705,000	+0.8	+0.0 -0.0
Industrial Drive (0.2 miles) (E)	2,032,000	R 24,000 C 369,000	+0.2	+0.0 -0.0
Lee Avenue (1.0 miles) (W)	19,563,000	R 29,000 C 1,871,000	+0.4	+0.1 -0.2
Lemon Springs Road (1.3 miles) (W)	2,573,000	R 18,000 C 2,411,000	+0.2	+0.0 -0.0
Lower Moncure Road (0.3 miles) (E)	5,868,000	R 83,000 C 455,000	+0.2	+0.1 -0.1
Main Street (0.8 miles) (W)	15,693,000	R 1,684,000 C 1,511,000	+0.7	+0.1 -0.2
McNeill Road (0.2 miles) (R)	1,459,000	R 93,000 C 227,000	+0.1	+0.0 -0.0
Northwest Connect (1.6 miles) (C)	44,304,000	R 235,000 C 2,330,000	+0.8	+0.1 -0.1
Perkinson Road (2.8 miles) (E)	20,234,000	R 136,000 C 4,205,000	+0.9	+0.1 -0.1
Pumping Station Rd (3.2 miles) (E)	99,407,000	R 377,000 C 4,830,000	+0.3	+0.1 -0.2
Rose Street North (0.2 miles) (E)	5,556,000	R 5,000 C 227,000	+0.1	+0.1 -0.1
Rose Street South (0.7 miles) (E)	9,852,000	R 109,000 C 682,000	+0.2	+0.1 -0.0
Sanford Bypass (11.6 miles) (C)	238,827,000	R 3,015,000 107,212,000	+1.0	+0.3 -0.2
Southern Loop East (2.9 miles) (C)	5,543,000	R 428,000 C 4,403,000	+1.0	+0.1 -0.2
Southern Loop West (6.8 miles) (C)	121,072,000	R 1,431,000 C10,227,000	+1.0	+0.1 -0.1

TABLE 7
SANFORD BENEFITS, COSTS, AND IMPACTS ESTIMATES

PROJECT	BENEFITS dollars	COSTS dollars	ECONOM IMPACT	ENVIRO IMPACT
Tempting Church Rd (2.2 miles) (E)	98,864,000	R 53,000 C 4,045,000	+0.5	+0.1 -0.1
Third Street (0.6 miles) (E)	14,612,000	R 21,000 C 1,409,000	+0.4	+0.0 -0.0
US1 Freeway (7.3 miles) (W)	34,906,000	R 124,000 C29,167,000	+1.0	+0.0 -0.0
Vance Street North (0.1 miles) (E)	984,000	R 130,000 C 95,000	+0.1	+0.0 -0.1
Vance Street South (0.2 miles) (E)	734,000	R 2,000 C 170,000	+0.1	+0.0 -0.0
Weatherspoon St (0.2 miles) (E)	2,842,000	R 25,000 C 227,000	+0.1	+0.0 -0.1
Wilson Road (0.8 miles) (W)	2,084,000	R 71,000 C 1,475,000	+0.8	+0.0 -0.0

NOTES:
Benefits are calculated based upon vehicle operating cost savings, travel time cost savings, and accident cost savings over a 20-year period. Costs are estimated based upon statewide average values and are separated into right-of-way (R) and construction (C) components. Both benefits and costs are expressed in 1994 dollars. Economic impact is the potential to stimulate economic development in the immediate area of the project and is expressed on a scale of 0.0 for least likely to +1.0 for most likely. Environmental impact is the potential to change the physical/social environment in the vicinity of the project and may be positive or negative and is expressed on a scale of 0.0 for least likely to +1.0 for most likely for positive impacts and 0.0 for least likely to -1.0 for most likely for negative impacts. The environmental factors considered are air quality, water resources, soil and geology, wildlife, vegetation, neighborhoods, noise, education facilities, churches, park and recreational facilities, historic sites and landmarks, public health and safety, and aesthetics.[1]

(C) = construction of new pavement on new right-of-way which constructs an entirely new facility.
(E) = construction of new pavement on new right-of-way which extends from and continues an existing facility.
(R) = construction of new pavement on new right-of-way which relocates parallel to old segment of the existing facility
(W) = construction of new lanes on existing or widened right-of-way of an existing roadway.

TABLE 8
SANFORD PROJECT PRIORITY GROUPS

GROUP	MAP	NAME	TIP NUMBER
A	1	US1 Freeway Widening	R-2500 *
	2	Fayetteville Highway South Widening	R-2238 *
	3	Sanford Bypass Freeway Construction	R-2417 *
	4	Beechtree Drive Relocation	#
	5	Charlotte Avenue Extension	#
	6	Colon Road Relocation	#
	7	Cotten Road Extension	#
	8	Horner Boulevard Widening	U-2921
	9	Third Street Extension	U-2565
	10	Southern Loop West Construction	U-2566
B	11	Wilson Road Widening	--
	12	Southern Loop East Construction	--
	13	Fayetteville Highway North Relocat.	--
	14	Broadway Road Widening	--
	15	Lee Avenue Widening	--
	16	Bragg Street Extension	--
	17	Hawkins Avenue Widening	--
	18	Harkey Road East Extension	--
	19	Rose Street North Extension	--
	20	Harkey Road West Extension	--
C	21	Burns Drive Extension	--
	22	Deep River Road Widening	--
	23	Lemon Springs Road Widening	--
	24	Main Street Widening	--
	25	Weatherspoon Street Extension	--
	26	Vance Street South Extension	--
	27	Rose Street South Extension	--
	28	Fields Drive Extension	--
	29	Canterbury Road Extension	--
			--
D	30	Northwest Connector Road Construct.	
	31	Perkinson Road Extension	--
	32	Industrial Drive Extension	--
	33	Tempting Church Road Extension	--
	34	Lower Moncure Road Extension	--
	35	Vance Street North Extension	--
	36	Pumping Station Road Extension	--
	37	Bruce Coggins Road Extension	--
	38	McNeill Road Relocation	--
	39	Carbonton Road Extension	--

NOTES:
Group A projects are either projects currently listed in the Transportation Improvement Program or projects that are closely linked to them. Group B projects are those that are not currently programed but have high value and importance for the City of Sanford. Group C projects are those projects that have medium

priority for the City. Group D projects have either lesser value or lower priority for Sanford.
* Project on the North Carolina Intrastate System.
# Project related to the Sanford Bypass Freeway (Project R-2417).

[1] North Carolina Department of Transportation, Transportation Project Evaluation Using The Benefits Matrix Model, Technical Report 8, 1983; and NCDOT, Benefits Matrix Model Cost Update, Second Supplement To Technical Report 8, 1988.

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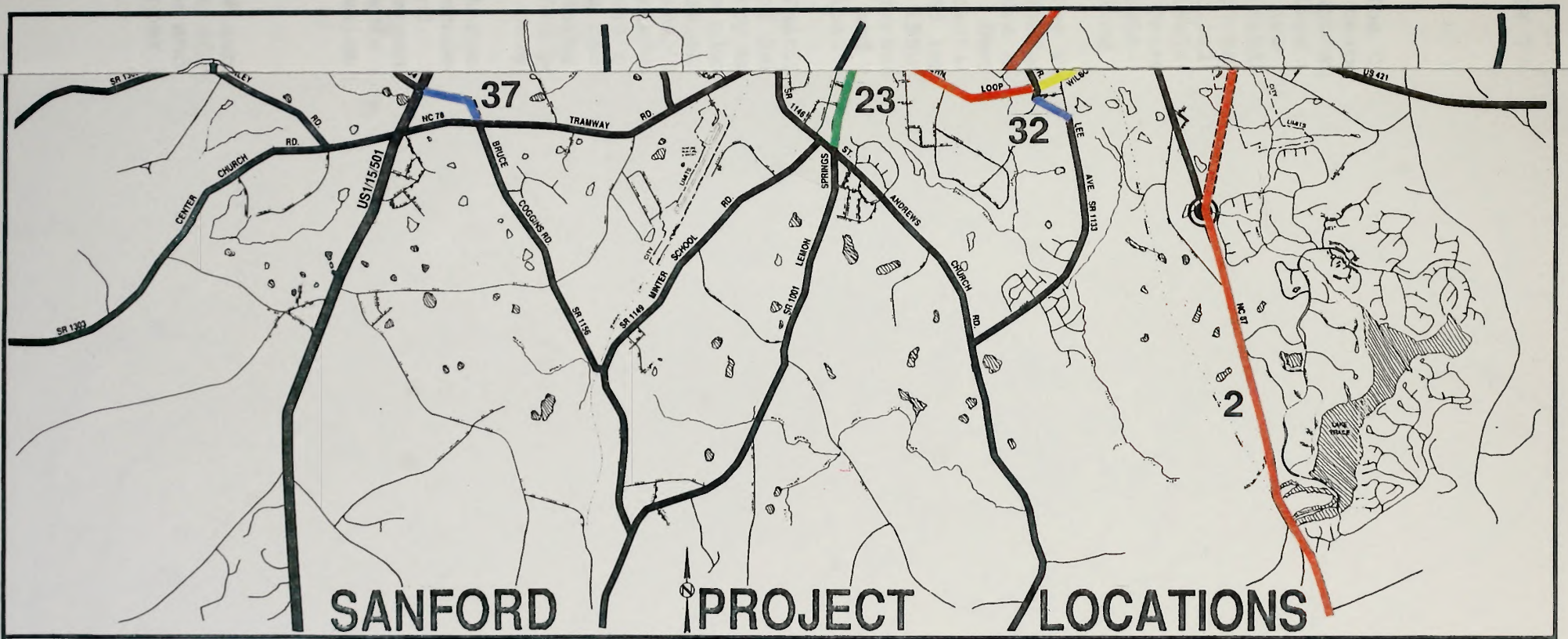

REVISIONS

CITY OF SANFORD	STATEWIDE PLANNING BRANCH	N. C. DEPARTMENT OF TRANSPORTATION
11/16/93	1/19/94	2/4/94

ADOPTED BY:

PUBLIC HEARING	MARCH 3, 1992
CITY OF SANFORD	APRIL 21, 1992
STATEWIDE PLANNING BRANCH	APRIL 23, 1992 M.R. Wall
N.C. DEPARTMENT OF TRANSPORTATION	MAY 8, 1992

FIGURE 22

LEGEND

	EXISTING	PROPOSED
FREEWAY / EXPRESSWAY	▬▬	▬▬
MAJOR THOROUGHFARE	▬▬	▬ ▬
MINOR THOROUGHFARE	──	─ ─
INTERCHANGE	●	◉
GRADE SEPARATION	○	◌

GROUP A PROJECTS
GROUP B PROJECTS
GROUP C PROJECTS
GROUP D PROJECTS

THOROUGHFARE PLAN
CITY OF SANFORD
LEE COUNTY
NORTH CAROLINA

PREPARED BY THE
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH
IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

APRIL 16, 1992

0 2000 4000 6000 8000
SCALE IN FEET

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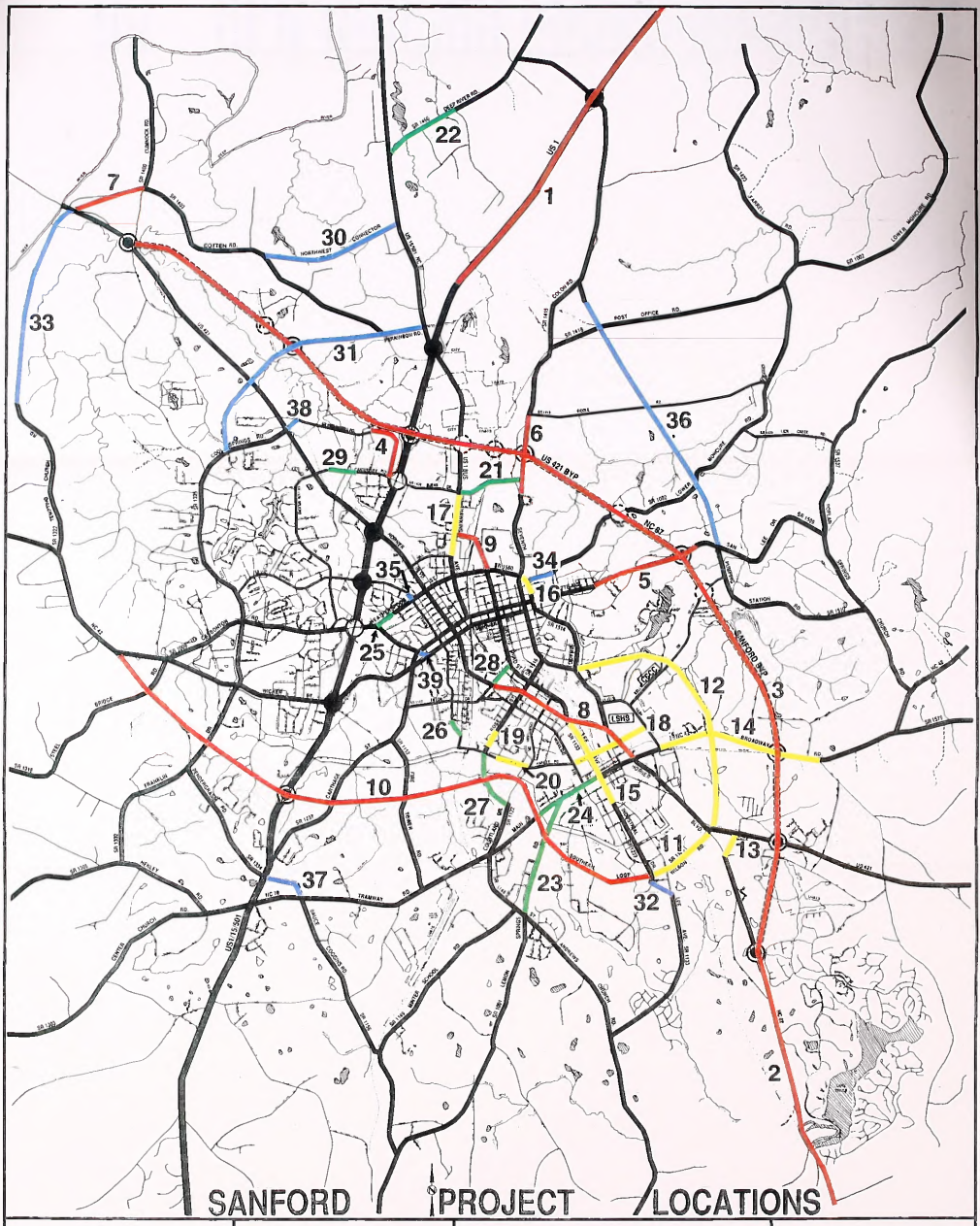

REVISIONS

CITY OF SANFORD	STATEWIDE PLANNING BRANCH	U. S. DEPARTMENT OF TRANSPORTATION
10/16/92	1/10/94	2/94

ADOPTED BY:

PUBLIC HEARING	MARCH 3, 1992
CITY OF SANFORD	APRIL 21, 1992
STATEWIDE PLANNING BRANCH	APRIL 23, 1992
N.C. DEPARTMENT OF TRANSPORTATION	MAY 8, 1992

FIGURE 22

LEGEND

	EXISTING	PROPOSED
FREEWAY / EXPRESSWAY	▬▬	▬▬
MAJOR THOROUGHFARE	▬▬	▬ ▬
MINOR THOROUGHFARE	▬▬	▬ ▬
INTERCHANGE	●	◉
GRADE SEPARATION	○	◌

GROUP A PROJECTS
GROUP B PROJECTS
GROUP C PROJECTS
GROUP D PROJECTS

THOROUGHFARE PLAN
CITY OF SANFORD
LEE COUNTY
NORTH CAROLINA

PREPARED BY THE
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS STATEWIDE PLANNING BRANCH
IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

APRIL 16, 1992

0 2000 4000 6000 8000
SCALE IN FEET

IMPLEMENTATION

The City of Sanford and the State of North Carolina have joint responsibility for the implementation of the Sanford Thoroughfare Plan. North Carolina General Statute 136-66.1 specifies which elements of a plan are a State responsibility and which are a City responsibility. In general, the State is responsible for those facilities which will serve major volumes of through traffic and external traffic proceeding inward to major commercial, industrial, and institutional areas within the municipality. The City is responsible for those facilities which serve primarily internal travel. The City will share a portion of the right-of-way cost on projects constructed by the State depending upon the degree of benefits to the municipality.

The recommended construction improvements in the Sanford Thoroughfare Plan will cost millions of dollars. Table 22 in Appendix E summarizes information on these improvements in tabular form. Declining gasoline tax revenues and increasing road construction costs have greatly reduced the ability of the State to fund improvements. North Carolina's highway needs for the years 1990 through 2000 total approximately $16 billion.[1] Transportation needs far outweigh the available funding. The State and the federal government are relying increasingly on municipal and private funding.

Initiative for plan implementation rests largely with the City of Sanford. Implementation of the plan will not be easy. The City may use a number of procedures, resources, and tools to aid in plan implementation. These include city funding, federal revenue sharing or block grants, urban bonds, urban redevelopment programs, municipal service districts, zoning ordinances, subdivision ordinances, future street line ordinances, advance purchase of right-of-way, and lobbying for State construction of needed facilities which are State responsibility. Effective and continuing use of available resources, tools, and programs over an extended period of time will result in the recommended projects being developed.

A number of the administrative tools and procedures recommended for project implementation may be appropriate for Sanford. Many of these may be used effectively to make improvements to other elements of the street system which would be desirable but which are not identified as specific needs. A discussion of these tools and procedures is given below.

SUBDIVISION CONTROL

A subdivision ordinance requires that every developer submit a plat of his proposed subdivision to the Planning Board for review and approval. Certain standards must be met by the developer before he can receive permission to construct his

development. Through this process, the necessary right-of-way for streets which are part of the thoroughfare plan may be obtained or protected from development. Street construction in accordance with the plan can be required of the developer.

Appendix D gives recommended definitions and design standards for subdivision ordinances. Sanford currently has extraterritorial jurisdiction for zoning and planning. A review of Sanford's present ordinances to insure that they are compatible with the thoroughfare plan is desirable.

OFFICIAL STREET MAP

A municipality may, through special enabling legislation, adopt an official street map which indicates both existing and future street lines. No new construction or reconstruction of structures is permitted within the designated future street lines. This has over a period of time reduced the cost of additional right-of-way along densely developed thoroughfares which have required widening.

House Bill 1211 enables Sanford to protect and acquire right-of-way outside its corporate limits for street or sidewalk construction since this thoroughfare plan has been mutually adopted by the City of Sanford and the State of North Carolina. If Sanford funds acquisition of right-of-way for a State highway system street improvement project, the North Carolina Department of Transportation may reimburse the City in whole or in part for expenditures made by the City to acquire or fund the acquisition of right-of-way.

FUTURE STREET LINE ORDINANCE

This ordinance is of particular benefit were widening of a street will be necessary at some time in the future. A municipality, with legislative approval, may amend its charter to be empowered to adopt future street line ordinances. Through a metes-and-bounds description of a street's future right-of-way requirements, the City may prohibit new construction or reconstruction of existing structures within the future right-of-way. This approach requires a specific design for the facility and normally requires property surveys and public hearings to allow affected land owners to know what is proposed and to make appropriate adjustments without undue hardships. Recommended right-of-way and cross sections for thoroughfares are shown in Appendix E.

ZONING

Zoning ordinances are beneficial to thoroughfare planning in that planned locations of various land uses and their densities

can be achieved. This provides some stability upon which to base travel forecasts and to plan street development.

Other benefits include the establishment of standards for development which will facilitate smooth traffic operations on thoroughfares, the minimization of strip commercial development which creates traffic friction and traffic accident potential, and the requirement for off-street parking in new development with the intention of ultimately prohibiting curb parking on all major thoroughfares.

REDEVELOPMENT

Redevelopment is the term used to describe efforts toward the removal or rehabilitation of undesirable development. It is one of the few tools available to correct basic mistakes in the street system, such as poor design, poor layout, and too many streets. Redevelopment opportunities generally occur in older areas of cities.

MUNICIPAL SERVICE DISTRICTS

Under North Carolina General Statute, Chapter 160A, Sections 535-543, the legislative body of a municipality may create one or more municipal service districts in a downtown commercial area in order to raise additional funds for physical improvements. One purpose of the district could be to facilitate traffic flow and parking. The district may issue bonds which would be paid off with revenues from an extra ad valorem tax on all property within the district's boundaries. Once the improvements are completed and the bonds are retired, the extra taxation would cease and the district would be dissolved.

CAPITAL IMPROVEMENTS PROGRAM

Another tool for building the thoroughfare system is the capital improvements program. This is a long-range plan for spending money on street improvements, right-of-way acquisition, and other capital improvements, within the bounds of projected revenues. The City will need funds for the construction of streets which are municipal responsibilities, for the sharing of costs of right-of-way of streets which are State responsibilities, and for the advance purchasing of right-of-way for future roadways where appropriate.

Table 7 shows the cost estimates for the recommended projects. These estimates are preliminary and are based upon general statewide averages of construction costs. The final costs of projects may be significantly higher or lower. Right-of-way costs could be minimized by exercising the planning controls previously described and by selectively advance purchasing right-

of-way as opportunities occur.

DEVELOPMENT REVIEWS

Requests for driveway access to state-maintained roadways are reviewed by the District Engineer's Office of the North Carolina Department of Transportation prior to approval being granted, as prescribed by North Carolina General Statute 136-93. Any development expected to generate large volumes of traffic, such as shopping centers, large industries, and so forth, may be comprehensively studied by a review team of staff personnel from Traffic Engineering Branch, Statewide Planning Branch, and Highway Design Branch. If this review occurs early in the development's design, access may often be improved with minimal expense. Since the City is often the first point of contact for developers, the City should advise them of this requirement and assist in the review.

IMPACT FEES

Municipalities may levy impact fees on new development to pay for the appropriate portion of off-site infrastructure improvements made necessary as a result of that development. A municipality seeking to impose impact fees must receive that authority from the state legislature.

STATE FUNDING SOURCES

The North Carolina Department of Transportation has several sources for funding highway improvements. The Transportation Improvement Program (TIP) funds major projects of statewide significance. The Secondary Road Improvement Program (SRIP) primarily funds paving of unpaved state-maintained secondary roads, but also may have additional monies for improvements to existing paved roads for safety and maintenance purposes. The Small Urban Fund (SUF) provides monies for low-cost urban projects which may not be addressed by the TIP. The Industrial Access Fund (IAF) can assist municipalities in attracting new industries by providing for access to existing state-maintained roadways.

[1] North Carolina Department of Transportation, Transportation Improvement Program 1991-1997, NCDOT: Raleigh (1990), page HP-1.

APPENDICES

APPENDIX A

1990 Socioeconomic Data

2010 Socioeconomic Data

2020 Socioeconomic Data

APPENDIX B

1990 Internal Data Summary

2010 Internal Data Summary

2020 Internal Data Summary

APPENDIX C

Trip Length Distribution

External Station Traffic Volumes

APPENDIX D

Recommended Subdivision Ordinances
- Definitions
- Design Standards

APPENDIX E

Thoroughfare Plan Street Tabulation

Thoroughfare Cross Sections
- Cross Section Explanations
- Cross Section Illustrations

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APPENDIX A

TABLE 9
SANFORD 1990 BASE YEAR DWELLING AND VEHICLE SUMMARY

ZONE	EXCELLENT	ABOVE	AVERAGE	BELOW	POOR	TAXI	TRK&AUTO
1	22	162	432	85	66	1	67
2	0	5	21	215	186	1	49
3	0	1	163	268	442	1	90
4	4	27	252	337	207	0	124
5	0	0	49	92	385	0	35
6	11	60	141	47	48	0	13
7	51	285	91	18	0	0	0
8	0	37	135	4	0	0	0
9	335	190	92	7	1	0	16
10	3	9	10	80	1	0	87
11	0	30	67	2	0	0	25
12	37	66	114	237	108	0	52
13	3	5	40	103	64	0	0
14	0	0	16	87	47	0	0
15	0	56	62	131	18	0	4
16	0	8	23	19	3	0	0
17	4	24	55	266	33	0	0
18	0	0	56	69	25	0	24
19	0	2	3	20	25	0	8
20	0	2	3	22	23	0	64
21	1	2	71	311	23	0	143
22	3	11	32	57	38	0	37
23	9	10	58	53	952	0	0
24	4	14	125	125	18	0	20
25	0	57	59	145	0	0	0
26	4	90	202	97	63	0	4
27	0	1	35	95	23	0	177
28	0	3	39	65	3	0	3
29	0	0	4	12	9	0	42
30	2	40	156	62	107	0	20
31	0	4	100	4	1	0	0
32	1	2	27	231	21	0	0
33	3	8	76	26	136	0	5
34	1	4	65	28	11	0	0
35	0	3	69	127	27	0	0
36	0	1	42	74	12	0	6
37	2	112	110	43	125	0	13
38	0	9	32	56	27	0	0
39	16	86	80	26	12	0	0
40	42	3	25	27	19	0	2
41	6	24	16	6	3	0	0
42	3	15	15	18	13	0	0
43	0	2	17	24	5	0	31
44	2	4	48	4	4	0	35
45	6	27	36	7	7	0	2
46	5	22	49	18	2	0	53
47	0	0	7	13	9	0	2
48	3	11	26	155	35	0	60
49	0	38	19	50	17	0	47
50	0	3	16	42	23	0	7
51	0	0	0	35	20	0	0
TOTAL	583	1575	3481	4145	3447	3	1367

TABLE 10
SANFORD 1990 BASE YEAR EMPLOYMENT SUMMARY

ZONE	INDUSTRY	SALES	SPECIAL	OFFICE	SERVICE
1	136	56	29	313	199
2	125	6	5	212	6
3	295	21	25	21	65
4	255	174	376	140	187
5	29	248	60	146	717
6	31	15	15	0	123
7	0	0	5	0	181
8	0	313	105	22	15
9	200	2	51	0	16
10	248	118	57	0	70
11	808	0	0	0	0
12	387	39	14	0	48
13	0	0	2	0	1
14	0	0	0	0	0
15	0	18	3	0	402
16	0	0	0	0	0
17	0	1	10	0	90
18	677	0	0	0	7
19	0	176	166	29	182
20	308	280	133	5	15
21	832	260	8	0	21
22	857	4	0	0	0
23	15	13	6	11	81
24	184	4	13	3	0
25	0	0	0	0	0
26	12	4	0	5	77
27	625	110	123	6	29
28	0	184	28	15	35
29	43	75	18	33	86
30	10	23	15	14	17
31	0	0	0	0	0
32	0	0	0	0	0
33	11	15	5	3	21
34	39	40	0	3	9
35	1	23	6	1	24
36	0	25	11	0	3
37	7	11	16	3	36
38	0	2	1	0	0
39	0	0	6	0	0
40	1	4	3	0	0
41	0	0	0	0	0
42	0	0	0	0	0
43	473	0	8	22	0
44	664	4	0	0	1
45	1	0	0	0	6
46	42	33	10	1	7
47	11	3	7	0	0
48	1366	12	5	0	1
49	304	0	20	2	23
50	4	0	0	0	1
51	0	0	0	0	0
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TOTAL	9001	2316	1365	1010	2802

TABLE 11
SANFORD 2010 DESIGN YEAR DWELLING AND VEHICLE SUMMARY

ZONE	EXCELLENT	ABOVE	AVERAGE	BELOW	POOR	TAXI	TRK&AUTO
1	51	230	279	168	100	1	61
2	0	3	16	193	243	1	60
3	0	0	138	269	469	1	108
4	0	26	221	426	169	0	100
5	0	0	29	117	451	0	37
6	20	75	178	118	69	0	13
7	30	240	211	60	9	0	0
8	0	70	132	27	0	0	0
9	301	339	201	30	1	0	8
10	0	0	19	57	31	0	12
11	0	25	69	40	0	0	27
12	67	82	115	212	120	0	54
13	0	2	64	171	68	0	0
14	0	0	40	219	137	0	0
15	0	83	108	137	62	0	12
16	0	10	29	23	6	0	0
17	6	41	78	332	41	0	0
18	0	0	56	68	50	0	35
19	0	0	0	0	0	0	10
20	0	1	1	11	12	0	78
21	0	0	45	439	46	0	143
22	14	23	32	63	34	0	45
23	15	27	288	333	1012	0	0
24	11	37	225	125	68	0	44
25	5	66	68	197	20	0	0
26	32	133	214	168	47	0	3
27	0	0	22	79	47	0	171
28	0	2	27	47	32	0	1
29	0	0	2	13	7	0	25
30	0	72	169	72	92	0	28
31	4	26	136	28	5	0	0
32	0	2	43	166	121	0	0
33	5	20	114	40	118	0	5
34	2	10	73	57	10	0	0
35	0	13	105	141	46	0	0
36	4	19	62	65	25	0	6
37	9	128	129	98	65	0	12
38	0	17	52	79	23	0	0
39	46	144	121	36	6	0	4
40	63	45	38	20	17	0	2
41	7	41	25	5	1	0	0
42	0	11	16	18	19	0	0
43	0	9	29	16	8	0	43
44	0	0	28	24	4	0	41
45	15	42	60	16	7	0	1
46	2	14	43	30	5	0	68
47	0	0	16	10	6	0	9
48	22	50	39	65	45	0	75
49	12	77	39	79	17	0	83
50	0	16	42	40	24	0	7
51	150	250	40	10	2	0	0
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TOTAL	893	2521	4326	5257	4017	3	1431

APPENDIX A

TABLE 12
SANFORD 2010 DESIGN YEAR EMPLOYMENT SUMMARY

ZONE	INDUSTRY	SALES	SPECIAL	OFFICE	SERVICE
1	150	84	87	206	219
2	138	30	30	265	30
3	369	40	50	42	71
4	192	208	318	182	244
5	26	285	84	146	757
6	31	20	30	80	231
7	0	0	10	24	217
8	0	407	136	44	39
9	90	86	204	30	64
10	289	171	102	60	35
11	930	0	0	20	0
12	445	69	14	32	28
13	0	12	38	0	4
14	0	12	24	0	12
15	18	54	12	36	582
16	0	0	0	0	0
17	0	4	25	0	105
18	764	0	0	0	35
19	0	184	141	58	227
20	454	322	120	15	22
21	1248	260	8	0	21
22	986	16	10	0	0
23	12	52	24	44	121
24	334	28	52	15	12
25	0	0	0	0	0
26	6	8	0	15	90
27	650	788	165	18	30
28	0	110	14	20	40
29	0	80	30	40	79
30	44	44	25	14	31
31	0	0	0	0	0
32	0	0	0	0	0
33	16	167	41	16	32
34	52	8	0	3	9
35	0	34	12	3	36
36	0	40	17	0	6
37	14	30	28	5	51
38	0	2	0	0	0
39	0	0	6	14	0
40	2	8	3	0	0
41	0	0	0	0	0
42	0	6	6	0	0
43	709	0	12	6	0
44	766	38	36	0	5
45	0	0	4	0	3
46	158	60	25	7	14
47	43	9	14	0	0
48	1689	36	30	9	5
49	395	450	35	18	41
50	4	10	10	0	5
51	0	0	0	0	0
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TOTAL	11024	4272	2032	1487	3553

APPENDIX A

TABLE 13
SANFORD 2020 DESIGN YEAR DWELLING AND VEHICLE SUMMARY

ZONE	EXCELLENT	ABOVE	AVERAGE	BELOW	POOR	TAXI	TRK&AUTO
1	55	227	309	172	80	1	47
2	0	0	12	172	276	1	72
3	0	35	136	351	389	1	77
4	0	18	229	391	152	0	75
5	0	0	17	117	459	0	33
6	26	90	213	181	74	0	14
7	19	250	246	100	22	0	0
8	0	59	112	63	7	0	0
9	286	396	283	59	3	0	9
10	0	0	11	41	43	0	68
11	0	26	62	56	2	0	23
12	66	96	123	206	94	0	52
13	0	7	68	260	55	0	0
14	0	10	50	273	191	0	0
15	0	49	96	240	96	0	20
16	0	16	34	25	8	0	0
17	13	50	95	301	85	0	24
18	0	0	48	66	58	0	40
19	0	0	0	0	0	0	12
20	0	0	0	3	2	0	70
21	0	0	94	380	92	0	201
22	19	32	40	40	25	0	37
23	20	36	288	604	1039	0	0
24	14	43	197	175	111	0	55
25	14	76	79	217	40	0	0
26	54	167	211	201	31	0	3
27	0	0	14	87	35	0	164
28	0	1	27	64	36	0	1
29	0	0	25	19	5	0	0
30	0	66	152	112	70	0	21
31	14	38	150	69	25	0	0
32	0	5	53	158	19	0	0
33	7	39	124	52	60	0	4
34	9	13	80	54	14	0	0
35	0	33	109	135	35	0	0
36	6	34	62	61	15	0	6
37	30	143	164	104	66	0	1
38	0	26	69	83	20	0	0
39	69	154	138	55	3	0	5
40	64	76	85	21	16	0	2
41	10	46	38	6	2	0	0
42	0	16	25	24	20	0	0
43	2	13	31	12	6	0	46
44	0	24	11	29	12	0	63
45	28	42	75	15	8	0	1
46	3	22	48	28	7	0	62
47	0	0	20	11	2	0	10
48	36	63	75	29	13	0	69
49	20	95	55	65	14	0	79
50	0	44	117	32	4	0	3
51	200	300	80	20	0	0	0
TOTAL	1084	2976	4880	6039	3491	3	1469

TABLE 14
SANFORD 2020 DESIGN YEAR EMPLOYMENT SUMMARY

ZONE	INDUSTRY	SALES	SPECIAL	OFFICE	SERVICE
1	115	105	109	258	240
2	68	36	24	397	60
3	258	46	50	50	79
4	116	249	269	209	280
5	13	312	90	152	797
6	34	25	42	112	301
7	0	0	15	36	239
8	0	407	136	55	52
9	81	94	215	60	80
10	147	188	100	69	107
11	834	0	0	40	0
12	424	63	10	46	32
13	0	36	72	0	11
14	0	24	36	0	24
15	36	72	44	66	682
16	0	0	0	0	0
17	96	20	40	0	120
18	809	0	16	0	65
19	0	202	141	111	232
20	341	354	108	30	44
21	1310	313	20	0	46
22	917	32	30	0	0
23	12	68	33	62	139
24	417	56	104	30	24
25	0	0	0	0	0
26	0	16	4	20	96
27	552	804	198	28	55
28	0	99	21	30	50
29	0	114	42	50	90
30	26	55	20	21	59
31	0	0	0	0	0
32	0	16	8	0	0
33	24	170	42	20	36
34	39	12	0	0	12
35	0	47	17	3	45
36	0	44	19	0	6
37	10	57	36	12	61
38	0	6	0	0	0
39	0	0	8	21	0
40	2	8	6	0	0
41	0	0	0	0	0
42	0	30	36	0	0
43	764	0	14	18	0
44	708	66	60	0	21
45	0	0	8	0	9
46	278	75	30	11	19
47	47	12	16	0	0
48	1605	138	57	24	30
49	386	495	38	34	57
50	0	78	40	0	86
51	0	0	0	0	0
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TOTAL	10469	5044	2424	2075	4386

APPENDIX B

TABLE 15

SANFORD 1990 BASE YEAR INTERNAL DATA SUMMARY

ZN	HBWAF	OAF	NAF	EAF	TOTTRP	INTTRP	HBWTRP	OHBTRP	NHBTRP	NHBSEC	EXTRPP	HBWAT	OHBAT	NHBAT	EXTRPA
1	733	2184	2030	2184	8115	7303	1680	4017	1607		0	1144	3282	2523	3426
2	354	958	872	958	3474	3127	719	1720	688		0	553	1440	1084	1503
3	427	1200	1025	1200	7081	6373	1466	3505	1402		0	667	1803	1274	1883
4	1132	4966	4800	4966	7665	6898	1587	3794	1518		0	1767	7462	5965	7790
5	1200	3448	3343	3448	3770	3393	780	1866	746		0	1874	5181	4155	5409
6	184	651	589	651	3024	2722	626	1497	599		0	287	978	732	1021
7	186	727	638	727	5137	4623	1063	2543	1017		0	290	1092	793	1140
8	455	1624	1589	1624	1826	1643	378	904	361		0	710	2440	1975	2548
9	269	984	859	984	7724	6952	1599	3824	1529		0	420	1479	1068	1544
10	493	1167	1146	1167	1476	1328	305	730	292		0	770	1754	1424	1831
11	808	858	838	858	1213	1092	251	601	240		0	1262	1289	1041	1346
12	488	977	865	977	5305	4774	1098	2626	1050		0	762	1468	1075	1533
13	3	128	85	128	1707	1536	353	845	338		0	5	192	106	201
14	0	75	45	75	1138	1024	236	563	225		0	0	113	56	118
15	423	1216	1162	1216	2475	2227	512	1225	490		0	660	1827	1444	1908
16	0	27	16	27	496	446	103	245	98		0	0	41	20	42
17	101	506	430	506	3216	2894	666	1592	637		0	158	760	534	794
18	684	770	740	770	1423	1281	295	705	282		0	1068	1157	920	1208
19	553	2269	2259	2269	418	376	86	207	83		0	863	3410	2807	3560
20	741	2000	1990	2000	797	717	165	394	158		0	1157	3005	2473	3138
21	1121	1625	1543	1625	4331	3898	897	2144	858		0	1750	2442	1918	2549
22	861	935	906	935	1423	1281	295	705	282		0	1344	1405	1126	1467
23	126	865	649	865	6953	6258	1439	3442	1377		0	197	1300	807	1357
24	204	451	394	451	2712	2441	561	1343	537		0	319	678	490	708
25	0	131	78	131	2434	2191	504	1205	482		0	0	197	97	206
26	98	456	365	456	4333	3900	897	2145	858		0	153	685	454	715
27	893	2018	1987	2018	2446	2201	506	1211	484		0	1394	3032	2469	3166
28	262	748	726	748	984	886	204	487	195		0	409	1124	902	1173
29	255	646	641	646	471	424	98	233	93		0	398	971	797	1013
30	79	439	365	439	3338	3004	691	1652	661		0	123	660	454	689
31	0	55	33	55	1086	977	225	537	215		0	0	83	41	86
32	0	141	85	141	2281	2053	472	1129	452		0	0	212	106	221
33	55	267	217	267	1952	1757	404	966	387		0	86	401	270	419
34	91	197	175	197	1001	901	207	496	198		0	142	296	217	309
35	55	269	224	269	1904	1714	394	943	377		0	86	404	278	422
36	39	210	184	210	1136	1022	235	562	225		0	61	316	229	329
37	73	457	379	457	3651	3286	756	1807	723		0	114	687	471	717
38	3	74	49	74	1038	934	215	514	205		0	5	111	61	116
39	6	160	116	160	2320	2088	480	1148	459		0	9	240	144	251
40	8	91	68	91	1175	1057	243	581	233		0	12	137	85	143
41	0	28	17	28	592	533	123	293	117		0	0	42	21	44
42	0	32	19	32	591	532	122	293	117		0	0	48	24	50
43	503	621	611	621	624	562	129	309	124		0	785	933	759	974
44	669	705	693	705	844	760	175	418	167		0	1045	1059	861	1106
45	7	58	41	58	873	786	181	432	173		0	11	87	51	91
46	93	254	235	254	1330	1197	275	658	263		0	145	382	292	398
47	21	90	84	90	241	217	50	119	48		0	33	135	104	141
48	1384	1548	1502	1548	2283	2055	473	1130	452		0	2161	2326	1867	2428
49	349	597	572	597	1463	1317	303	724	290		0	545	897	711	937
50	5	49	32	49	717	645	148	355	142		0	8	74	40	77
51	0	28	17	28	400	360	83	198	79		0	0	42	21	44

APPENDIX B

TABLE 15
SANFORD 1990 BASE YEAR INTERNAL DATA SUMMARY

52	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	0	0	0	0	0	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	0	0	0	0	0	0	0	0	0	0	4214	0	0	0
102	0	0	0	0	0	0	0	0	0	0	3593	0	0	0
103	0	0	0	0	0	0	0	0	0	0	6821	0	0	0

TABLE 15
SANFORD 1990 BASE YEAR INTERNAL DATA SUMMARY

104	0	0	0	0	0	0	0	0	0	921	0	0	0	0
105	0	0	0	0	0	0	0	0	0	38	0	0	0	0
106	0	0	0	0	0	0	0	0	0	733	0	0	0	0
107	0	0	0	0	0	0	0	0	0	411	0	0	0	0
108	0	0	0	0	0	0	0	0	0	36	0	0	0	0
109	0	0	0	0	0	0	0	0	0	1684	0	0	0	0
110	0	0	0	0	0	0	0	0	0	4087	0	0	0	0
111	0	0	0	0	0	0	0	0	0	347	0	0	0	0
112	0	0	0	0	0	0	0	0	0	5350	0	0	0	0
113	0	0	0	0	0	0	0	0	0	838	0	0	0	0
114	0	0	0	0	0	0	0	0	0	6814	0	0	0	0
115	0	0	0	0	0	0	0	0	0	1032	0	0	0	0
116	0	0	0	0	0	0	0	0	0	1235	0	0	0	0
117	0	0	0	0	0	0	0	0	0	3367	0	0	0	0
118	0	0	0	0	0	0	0	0	0	706	0	0	0	0
119	0	0	0	0	0	0	0	0	0	1952	0	0	0	0
120	0	0	0	0	0	0	0	0	0	7991	0	0	0	0
121	0	0	0	0	0	0	0	0	0	822	0	0	0	0
122	0	0	0	0	0	0	0	0	0	1229	0	0	0	0
123	0	0	0	0	0	0	0	0	0	753	0	0	0	0
124	0	0	0	0	0	0	0	0	0	1331	0	0	0	0
125	0	0	0	0	0	0	0	0	0	1390	0	0	0	0
126	0	0	0	0	0	0	0	0	0	6179	0	0	0	0
127	0	0	0	0	0	0	0	0	0	414	0	0	0	0
	16494	40980	38328	40980	124407	111966	25752	61581	24633	23000	64288	25752	61579	47636	64289

NOTES

-HBWAFs were developed using a regression equation

TRIP PERCENTAGES

INTERNAL OF TOTAL = 90.0%
HBW OF INTERNAL = 23.0%
OHB OF INTERNAL = 55.0%
NHB OF INTERNAL = 22.0%

OTHER RESULTS

AVERAGE DU GENERATION RATE = 8.70 Trips/DU
(Only includes 5 standard housing class)

EMPLOYEE/POPULATION RATIO = .51 EMP/PER
Allowable Ranges for Employee/Population Ratio

EMP/POP	INT OF TOTAL
40-50%	80-85%
50-60%	85-90%

TOTAL NHBS trips = 23000
(Your NHBS trips should be between 15927 and 26546)

INTERNAL TRIPS

Total Internal Trips = 111966
HBW trips = 25752
NHB Trips = 24633
OHB Trips = 61581
External Trips = 64288

TABLE 16
SANFORD 2010 DESIGN YEAR INTERNAL DATA SUMMARY

ZN	HBWAF	OAF	NAF	EAF	TOTTRP	INTTRP	HBWTRP	OHBTRP	NHBTRP	NHBSEC	EXTRPP	HBWAT	OHBAT	NHBAT	EXTRPA
1	746	2536	2370	2536	8606	7745	1781	4260	1704		0	1111	3537	2729	4069
2	493	1436	1345	1436	3640	3276	753	1802	721		0	734	2003	1549	2304
3	572	1587	1412	1587	7110	6399	1472	3519	1408		0	852	2213	1626	2546
4	1144	4740	4572	4740	7614	6853	1576	3769	1508		0	1704	6610	5264	7606
5	1298	3850	3730	3850	4180	3762	865	2069	828		0	1934	5369	4295	6178
6	392	1345	1253	1345	4385	3946	908	2170	868		0	584	1876	1443	2158
7	251	974	864	974	5914	5323	1224	2928	1171		0	374	1358	995	1563
8	626	2198	2152	2198	2376	2138	492	1176	470		0	933	3065	2478	3527
9	474	2627	2453	2627	10291	9262	2130	5094	2038		0	706	3664	2825	4215
10	657	1749	1727	1749	912	821	189	452	181		0	979	2439	1989	2806
11	950	1049	1022	1049	1491	1342	309	738	295		0	1415	1463	1177	1683
12	588	1138	1019	1138	5783	5205	1197	2863	1145		0	876	1587	1173	1826
13	54	503	442	503	2440	2196	505	1208	483		0	80	701	509	807
14	48	452	373	452	2974	2677	616	1472	589		0	72	630	429	725
15	702	1988	1910	1988	3624	3262	750	1794	718		0	1046	2772	2199	3190
16	0	34	20	34	630	567	130	312	125		0	0	47	23	55
17	134	733	633	733	4252	3827	880	2105	842		0	200	1022	729	1176
18	799	940	905	940	1638	1474	339	811	324		0	1190	1311	1042	1508
19	610	2240	2240	2240	67	60	14	33	13		0	909	3124	2579	3594
20	933	2145	2140	2145	705	634	146	349	139		0	1390	2991	2464	3442
21	1537	2102	1996	2102	5196	4676	1075	2572	1029		0	2290	2931	2298	3373
22	1012	1182	1149	1182	1787	1608	370	884	354		0	1508	1648	1323	1897
23	253	1568	1233	1568	12135	10921	2512	6007	2403		0	377	2187	1420	2516
24	441	1122	1029	1122	4540	4086	940	2247	899		0	657	1565	1185	1800
25	0	178	107	178	3233	2910	669	1601	640		0	0	248	123	286
26	119	585	466	585	5798	5218	1200	2870	1148		0	177	816	537	939
27	1651	3644	3614	3644	2280	2052	472	1129	451		0	2460	5082	4161	5847
28	184	523	501	523	869	782	180	430	172		0	274	729	577	839
29	229	711	707	711	333	300	69	165	66		0	341	992	814	1141
30	158	650	569	650	3870	3483	801	1916	766		0	235	906	655	1043
31	0	100	60	100	1978	1780	409	979	392		0	0	139	69	160
32	0	166	100	166	2508	2257	519	1241	497		0	0	231	115	266
33	272	933	873	933	2506	2255	519	1240	496		0	405	1301	1005	1497
34	72	173	143	173	1392	1253	288	689	276		0	107	241	165	278
35	85	414	353	414	2610	2349	540	1292	517		0	127	577	406	664
36	63	317	282	317	1610	1449	333	797	319		0	94	442	325	509
37	128	660	574	660	4197	3777	869	2077	831		0	191	920	661	1059
38	2	90	55	90	1494	1345	309	740	296		0	3	126	63	144
39	20	263	192	263	3887	3498	805	1924	770		0	30	367	221	422
40	13	133	96	133	2014	1813	417	997	399		0	19	185	111	213
41	0	40	24	40	879	791	182	435	174		0	0	56	28	64
42	12	93	80	93	550	495	114	272	109		0	18	130	92	149
43	727	856	844	856	862	776	178	427	171		0	1083	1194	972	1374
44	845	1176	1165	1176	771	694	160	382	153		0	1259	1640	1341	1887
45	7	111	83	111	1476	1328	305	730	292		0	10	155	96	178
46	264	576	557	576	1350	1215	279	668	267		0	393	803	641	924
47	66	192	186	192	336	302	69	166	66		0	98	268	214	308
48	1769	2152	2107	2152	2568	2311	532	1271	508		0	2635	3001	2426	3453
49	939	1762	1717	1762	2760	2484	571	1366	546		0	1399	2457	1977	2827
50	29	180	156	180	1123	1011	233	556	222		0	43	251	180	289
51	0	226	136	226	5442	4898	1127	2694	1078		0	0	315	157	363

APPENDIX B

TABLE 16
SANFORD 2010 DESIGN YEAR INTERNAL DATA SUMMARY

52	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	0	0	0	0	0	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	0	0	0	0	0	0	0	0	0	5373	0	0	0	0
102	0	0	0	0	0	0	0	0	0	5632	0	0	0	0
103	0	0	0	0	0	0	0	0	0	8793	0	0	0	0

TABLE 16
SANFORD 2010 DESIGN YEAR INTERNAL DATA SUMMARY

104	0	0	0	0	0	0	0	0	0	1200	0	0	0	0
105	0	0	0	0	0	0	0	0	0	200	0	0	0	0
106	0	0	0	0	0	0	0	0	0	1685	0	0	0	0
107	0	0	0	0	0	0	0	0	0	500	0	0	0	0
108	0	0	0	0	0	0	0	0	0	150	0	0	0	0
109	0	0	0	0	0	0	0	0	0	3256	0	0	0	0
110	0	0	0	0	0	0	0	0	0	4908	0	0	0	0
111	0	0	0	0	0	0	0	0	0	500	0	0	0	0
112	0	0	0	0	0	0	0	0	0	6975	0	0	0	0
113	0	0	0	0	0	0	0	0	0	1967	0	0	0	0
114	0	0	0	0	0	0	0	0	0	9419	0	0	0	0
115	0	0	0	0	0	0	0	0	0	1399	0	0	0	0
116	0	0	0	0	0	0	0	0	0	2695	0	0	0	0
117	0	0	0	0	0	0	0	0	0	5562	0	0	0	0
118	0	0	0	0	0	0	0	0	0	1779	0	0	0	0
119	0	0	0	0	0	0	0	0	0	3134	0	0	0	0
120	0	0	0	0	0	0	0	0	0	8991	0	0	0	0
121	0	0	0	0	0	0	0	0	0	1590	0	0	0	0
122	0	0	0	0	0	0	0	0	0	2152	0	0	0	0
123	0	0	0	0	0	0	0	0	0	1000	0	0	0	0
124	0	0	0	0	0	0	0	0	0	1779	0	0	0	0
125	0	0	0	0	0	0	0	0	0	2446	0	0	0	0
126	0	0	0	0	0	0	0	0	0	8005	0	0	0	0
127	0	0	0	0	0	0	0	0	0	600	0	0	0	0
	22368	57142	53736	57142	160986	144887	33324	79688	31875	30000	91690	33322	79685	61875	91687

NOTES

-HBWAFs were developed using a regression equation

TRIP PERCENTAGES

INTERNAL OF TOTAL = 90.0%
HBW OF INTERNAL = 23.0%
OHB OF INTERNAL = 55.0%
NHB OF INTERNAL = 22.0%

OTHER RESULTS

AVERAGE DU GENERATION RATE = 8.89 Trips/DU
(Only includes 5 standard housing class)

EMPLOYEE/POPULATION RATIO = .54 EMP/PER

Allowable Ranges for Employee/Population Ratio

EMP/POP	INT OF TOTAL
40-50%	80-85%
50-60%	85-90%

TOTAL NHBS trips = 30000
(Your NHBS trips should be between 23160 and 38601)

INTERNAL TRIPS

Total Internal Trips = 144887
HBW trips = 33324
NHB Trips = 31875
OHB Trips = 79688
External Trips = 91690

APPENDIX B

TABLE 17

SANFORD 2020 DESIGN YEAR INTERNAL DATA SUMMARY

ZN	HBWAF	OAF	NAF	EAF	TOTTRP	INTTRP	HBWTRP	OHBTRP	NHBTRP	NHBSEC	EXTRPP	HBWAT	OHBAT	NHBAT	EXTRPA
1	827	2920	2751	2920	8740	7866	1809	4326	1731		0	1267	3962	3091	4613
2	585	1749	1657	1749	3674	3307	761	1819	728		0	896	2373	1862	2763
3	483	1546	1363	1546	7478	6730	1548	3702	1481		0	740	2098	1531	2442
4	1123	4465	4307	4465	7048	6343	1459	3489	1395		0	1720	6058	4839	7054
5	1364	4051	3932	4051	4081	3673	845	2020	808		0	2089	5496	4418	6400
6	514	1781	1664	1781	5534	4981	1146	2740	1096		0	787	2416	1870	2814
7	290	1147	1019	1147	6639	5975	1374	3286	1314		0	444	1556	1145	1812
8	650	2267	2218	2267	2374	2137	492	1175	470		0	996	3076	2492	3581
9	530	2921	2715	2921	11850	10665	2453	5866	2346		0	812	3963	3051	4614
10	611	1821	1802	1821	1152	1037	239	570	228		0	936	2471	2025	2877
11	874	1011	982	1011	1546	1391	320	765	306		0	1339	1372	1103	1597
12	575	1116	999	1116	5800	5220	1201	2871	1148		0	881	1514	1122	1763
13	119	890	812	890	3174	2857	657	1571	629		0	182	1208	912	1406
14	84	667	562	667	3950	3555	818	1955	782		0	129	905	631	1054
15	900	2686	2589	2686	4178	3760	865	2068	827		0	1378	3644	2909	4243
16	0	42	25	42	780	702	161	386	154		0	0	57	28	66
17	276	1044	935	1044	4798	4318	993	2375	950		0	423	1416	1051	1649
18	890	1195	1161	1195	1624	1462	336	804	322		0	1363	1621	1305	1888
19	686	2424	2424	2424	80	72	17	40	16		0	1051	3289	2724	3829
20	877	2074	2073	2074	505	454	104	250	100		0	1343	2814	2329	3276
21	1689	2440	2327	2440	5879	5291	1217	2910	1164		0	2587	3310	2615	3855
22	979	1304	1273	1304	1749	1574	362	866	346		0	1499	1769	1430	2060
23	314	1919	1521	1919	14638	13174	3030	7246	2898		0	481	2604	1709	3032
24	631	1796	1688	1796	5102	4592	1056	2526	1010		0	966	2437	1897	2837
25	0	213	128	213	3860	3474	799	1911	764		0	0	289	144	336
26	136	691	558	691	6630	5967	1372	3282	1313		0	208	938	627	1092
27	1637	3935	3908	3935	2145	1930	444	1062	425		0	2507	5339	4391	6216
28	200	623	597	623	1017	915	210	503	201		0	306	845	671	984
29	296	940	930	940	432	389	89	214	86		0	453	1275	1045	1485
30	181	697	617	697	3769	3392	780	1866	746		0	277	946	693	1101
31	0	148	89	148	2840	2556	588	1406	562		0	0	201	100	234
32	24	214	167	214	1968	1771	407	974	390		0	37	290	188	338
33	292	966	910	966	2602	2342	539	1288	515		0	447	1311	1022	1526
34	63	177	143	177	1589	1430	329	787	315		0	96	240	161	280
35	112	506	444	506	2776	2498	575	1374	550		0	172	687	499	799
36	69	342	306	342	1724	1552	357	854	341		0	106	464	344	540
37	176	855	753	855	4981	4483	1031	2466	986		0	270	1160	846	1351
38	6	110	70	110	1786	1607	370	884	354		0	9	149	79	174
39	29	332	248	332	4616	4154	955	2285	914		0	44	450	279	524
40	16	197	145	197	2871	2584	594	1421	568		0	25	267	163	311
41	0	51	31	51	1122	1010	232	556	222		0	0	69	35	81
42	66	398	381	398	754	679	156	373	149		0	101	540	428	629
43	796	960	947	960	932	839	193	461	185		0	1219	1302	1064	1517
44	855	1421	1406	1421	1124	1012	233	557	223		0	1310	1928	1580	2245
45	17	174	140	174	1793	1614	371	888	355		0	26	236	157	275
46	413	795	773	795	1464	1318	303	725	290		0	633	1079	869	1256
47	75	220	213	220	367	330	76	182	73		0	115	298	239	348
48	1854	2576	2533	2576	2746	2471	568	1359	544		0	2840	3495	2846	4069
49	1010	1953	1903	1953	3083	2775	638	1526	610		0	1547	2650	2138	3085
50	204	792	752	792	1998	1798	414	989	396		0	312	1075	845	1251
51	0	300	180	300	7160	6444	1482	3544	1418		0	0	407	202	474

APPENDIX B

TABLE 17

SANFORD 2020 DESIGN YEAR INTERNAL DATA SUMMARY

52	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0
85	0	0	0	0	0	0	0	0	0	0	0	0	0	0
86	0	0	0	0	0	0	0	0	0	0	0	0	0	0
87	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0	0	0	0	0	0	0
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0
93	0	0	0	0	0	0	0	0	0	0	0	0	0	0
94	0	0	0	0	0	0	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	0	0	0	0	0	0	0	0	0	0	0	0	0	0
98	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	0	0	0	0	0	0	0	0	0	6133	0	0	0	0
102	0	0	0	0	0	0	0	0	0	6117	0	0	0	0
103	0	0	0	0	0	0	0	0	0	9430	0	0	0	0

APPENDIX B

TABLE 17

SANFORD 2020 DESIGN YEAR INTERNAL DATA SUMMARY

104	0	0	0	0	0	0	0	0	0	1500	0	0	0	0
105	0	0	0	0	0	0	0	0	0	300	0	0	0	0
106	0	0	0	0	0	0	0	0	0	2100	0	0	0	0
107	0	0	0	0	0	0	0	0	0	600	0	0	0	0
108	0	0	0	0	0	0	0	0	0	200	0	0	0	0
109	0	0	0	0	0	0	0	0	0	3805	0	0	0	0
110	0	0	0	0	0	0	0	0	0	5547	0	0	0	0
111	0	0	0	0	0	0	0	0	0	600	0	0	0	0
112	0	0	0	0	0	0	0	0	0	7902	0	0	0	0
113	0	0	0	0	0	0	0	0	0	2477	0	0	0	0
114	0	0	0	0	0	0	0	0	0	9830	0	0	0	0
115	0	0	0	0	0	0	0	0	0	1700	0	0	0	0
116	0	0	0	0	0	0	0	0	0	3370	0	0	0	0
117	0	0	0	0	0	0	0	0	0	6186	0	0	0	0
118	0	0	0	0	0	0	0	0	0	2197	0	0	0	0
119	0	0	0	0	0	0	0	0	0	3976	0	0	0	0
120	0	0	0	0	0	0	0	0	0	9537	0	0	0	0
121	0	0	0	0	0	0	0	0	0	2000	0	0	0	0
122	0	0	0	0	0	0	0	0	0	2661	0	0	0	0
123	0	0	0	0	0	0	0	0	0	1200	0	0	0	0
124	0	0	0	0	0	0	0	0	0	2197	0	0	0	0
125	0	0	0	0	0	0	0	0	0	2923	0	0	0	0
126	0	0	0	0	0	0	0	0	0	8858	0	0	0	0
127	0	0	0	0	0	0	0	0	0	700	0	0	0	0
	24398	65862	62071	65862	180522	162470	37368	89359	35743	34000	104046	37369	89359	69744	104046

NOTES

-HBWAFs were developed using a regression equation

TRIP PERCENTAGES

INTERNAL OF TOTAL = 90.0%
HBW OF INTERNAL = 23.0%
OHB OF INTERNAL = 55.0%
NHB OF INTERNAL = 22.0%

OTHER RESULTS

AVERAGE DU GENERATION RATE = 9.01 Trips/DU
(Only includes 5 standard housing class)

EMPLOYEE/POPULATION RATIO = .51 EMP/PER

Allowable Ranges for Employee/Population Ratio

EMP/POP	INT OF TOTAL
40-50%	80-85%
50-60%	85-90%

TOTAL NHBS trips = 34000
(Your NHBS trips should be between 26340 and 43900)

INTERNAL TRIPS

Total Internal Trips = 162470
HBW trips = 37368
NHB Trips = 35743
OHB Trips = 89359
External Trips = 104046

APPENDIX B

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APPENDIX C

TABLE 18
SANFORD 1990 BASE YEAR TRIP LENGTH DISTRIBUTION

TIME (MIN)	HBW %	HBW TRIPS	OHB %	OHB TRIPS	NHB+S %	NHB+S TRIPS	E-I %	E-I TRIPS
1	1.67	430	5.31	3,270	8.94	4,258	0.97	624
2	5.36	1,380	7.54	4,643	10.81	5,149	1.65	1,061
3	8.60	2,215	9.01	5,548	13.27	6,321	2.04	1,311
4	8.78	2,261	10.27	6,324	12.71	6,054	2.46	1,581
5	9.18	2,364	11.42	7,033	12.94	6,164	4.72	3,034
6	9.88	2,544	10.67	6,571	11.00	5,240	5.30	3,407
7	9.95	2,562	9.07	5,585	8.86	4,220	7.79	5,008
8	11.72	3,018	8.93	5,499	7.79	3,711	8.36	5,374
9	8.82	2,271	7.73	4,760	4.87	2,320	9.15	5,882
10	7.14	1,839	6.26	3,855	3.07	1,462	10.85	6,975
11	5.26	1,355	4.72	2,907	2.10	1,000	9.44	6,069
12	4.21	1,084	2.70	1,663	1.25	595	9.45	6,075
13	3.02	778	2.22	1,367	0.96	457	8.11	5,214
14	2.06	530	1.58	973	0.45	214	6.32	4,063
15	1.07	276	1.36	838	0.36	171	4.04	2,597
16	0.94	242	0.59	363	0.32	152	3.13	2,012
17	0.71	183	0.27	166	0.19	91	2.18	1,401
18	0.84	216	0.16	99	0.06	29	1.22	784
19	0.41	106	0.11	68	0.05	24	1.05	675
20	0.38	98	0.08	49	0	0	1.05	675
21	0	0	0	0	0	0	0.65	418
22	0	0	0	0	0	0	0.07	45
23	0	0	0	0	0	0	0	0
TOTAL	100.00	25,752	100.00	61,581	100.00	47,633	100.00	64,288

APPENDIX C

TABLE 19
SANFORD 2010 DESIGN YEAR TRIP LENGTH DISTRIBUTION

TIME (MIN)	HBW %	HBW TRIPS	OHB %	OHB TRIPS	NHB+S %	NHB+S TRIPS	E-I %	E-I TRIPS
1	1.67	557	5.31	4,231	8.94	5,532	0.97	889
2	5.36	1,786	7.54	6,008	10.81	6,689	1.65	1,513
3	8.60	2,866	9.01	7,180	13.27	8,211	2.04	1,870
4	8.78	2,926	10.27	8,184	12.71	7,864	2.46	2,256
5	9.18	3,059	11.42	9,100	12.94	8,007	4.72	4,328
6	9.88	3,292	10.67	8,503	11.00	6,806	5.30	4,860
7	9.95	3,316	9.07	7,228	8.86	5,482	7.79	7,143
8	11.72	3,906	8.93	7,116	7.79	4,820	8.36	7,665
9	8.82	2,939	7.73	6,160	4.87	3,013	9.15	8,390
10	7.14	2,379	6.26	4,988	3.07	1,900	10.85	9,948
11	5.26	1,753	4.72	3,761	2.10	1,299	9.44	8,656
12	4.21	1,403	2.70	2,152	1.25	773	9.45	8,665
13	3.02	1,006	2.22	1,769	0.96	594	8.11	7,436
14	2.06	686	1.58	1,259	0.45	278	6.32	5,795
15	1.07	357	1.36	1,084	0.36	223	4.04	3,704
16	0.94	313	0.59	470	0.32	198	3.13	2,870
17	0.71	237	0.27	215	0.19	118	2.18	1,999
18	0.84	280	0.16	128	0.06	37	1.22	1,119
19	0.41	137	0.11	88	0.05	31	1.05	963
20	0.38	127	0.08	64	0	0	1.05	963
21	0	0	0	0	0	0	0.65	596
22	0	0	0	0	0	0	0.07	64
23	0	0	0	0	0	0	0	0
TOTAL	100.00	33,324	100.00	79,688	100.00	61,875	100.00	91,690

TABLE 20
SANFORD 2020 DESIGN YEAR TRIP LENGTH DISTRIBUTION

TIME (MIN)	HBW %	HBW TRIPS	OHB %	OHB TRIPS	NHB+S %	NHB+S TRIPS	E-I %	E-I TRIPS
1	1.67	624	5.31	4,745	8.94	6,235	0.97	1,009
2	5.36	2,003	7.54	6,738	10.81	7,539	1.65	1,717
3	8.60	3,214	9.01	8,051	13.27	9,255	2.04	2,123
4	8.78	3,281	10.27	9,177	12.71	8,864	2.46	2,560
5	9.18	3,430	11.42	10,205	12.94	9,025	4.72	4,911
6	9.88	3,692	10.67	9,535	11.00	7,672	5.30	5,514
7	9.95	3,718	9.07	8,105	8.86	6,179	7.79	8,105
8	11.72	4,380	8.93	7,980	7.79	5,433	8.36	8,698
9	8.82	3,296	7.73	6,907	4.87	3,396	9.15	9,520
10	7.14	2,668	6.26	5,594	3.07	2,141	10.85	11,289
11	5.26	1,966	4.72	4,218	2.10	1,465	9.44	9,822
12	4.21	1,573	2.70	2,413	1.25	872	9.45	9,832
13	3.02	1,129	2.22	1,984	0.96	670	8.11	8,438
14	2.06	770	1.58	1,412	0.45	314	6.32	6,576
15	1.07	400	1.36	1,215	0.36	251	4.04	4,203
16	0.94	351	0.59	527	0.32	223	3.13	3,257
17	0.71	265	0.27	241	0.19	133	2.18	2,268
18	0.84	314	0.16	143	0.06	42	1.22	1,269
19	0.41	153	0.11	98	0.05	35	1.05	1,092
20	0.38	142	0.08	71	0	0	1.05	1,092
21	0	0	0	0	0	0	0.65	676
22	0	0	0	0	0	0	0.07	73
23	0	0	0	0	0	0	0	0
TOTAL	100.00	37,368	100.00	89,359	100.00	69,743	100.00	104,046

TABLE 21
SANFORD EXTERNAL STATION TRAFFIC VOLUMES

ROUTE	1960	1970	1980	1990	2000	2010	2020
US15N	2,280	2,700	4,000	4,900	5,800	6,700	7,700
SR1466	2,750	4,150	3,800	4,800	6,000	6,500	7,000
US1N	---	---	4,100	7,700	11,300	15,000	17,000
SR1423	---	---	400	300	600	1,200	1,500
SR1424	---	---	20	30	100	200	300
SR1002	---	1,290	500	900	1,300	1,700	2,100
SR1537	---	270	230	300	400	500	600
NC42E	500	800	1,500	2,200	2,800	3,700	4,300
SR1579	2,450	4,500	3,200	4,300	4,900	5,500	6,200
ALMA B	---	---	---	40	100	150	200
SR1533	---	---	350	300	400	500	600
US421S	NA	NA	4,700	6,300	8,000	9,600	11,200
SR1529	---	---	700	1,000	1,500	2,000	2,500
NC87S	2,600	4,800	7,900	11,700	15,600	18,100	20,000
SR1140	90	140	500	700	1,000	1,400	1,700
SR1146	---	350	900	1,400	2,100	2,800	3,500
SR1001	1,000	1,290	2,200	3,700	5,400	6,400	7,100
SR1156	90	250	---	900	1,300	1,800	2,200
SR1158	---	---	1,000	1,800	2,600	3,300	4,200
US1/15	5,250	6,500	9,500	11,700	13,800	16,200	18,400
SR1300	---	---	420	800	1,200	1,600	2,000
SR1303	780	310	---	1,300	1,700	2,200	2,700
SR1305	---	460	180	300	400	500	600
SR1318	280	180	650	900	1,300	1,800	2,200
NC42W	520	920	1,600	1,900	2,400	2,700	3,200
US421N	2,150	4,100	5,500	8,500	10,200	12,100	14,000
SR1400	---	500	---	400	500	600	700

All values measured in vehicles per day (vpd).

APPENDIX D

RECOMMENDED SUBDIVISION ORDINANCES

DEFINITIONS

I. Streets And Roads

A. Rural Roads

1. Principal Arterial - A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes, Intrastate routes, and other routes designated as principal arterials.

2. Minor Arterial - A rural roadway joining cities and larger towns and providing intrastate and inter-county service at relatively high overall travel speeds with minimum interference to through movement.

3. Major Collector - A road which serves major intra-county travel corridors and traffic generators and provides access to the Arterial system.

4. Minor Collector - A road which provides service to smaller communities and traffic generators and provides access to the Major Collector system.

5. Local Road - A road which serves primarily to provide access to adjacent land, over relatively short distances.

B. Urban Streets

1. Major Thoroughfares - Major thoroughfares consist of Interstate, Intrastate other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of volumes of traffic within and through urban areas.

2. Minor Thoroughfares - Minor thoroughfares perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thoroughfare system by facilitating minor through traffic movements and may also serve abutting property.

3. Local Street - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

C. Specific Type Rural Or Urban Streets

1. Freeway - Divided multilane highway designed to carry large volumes of traffic at higher speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. (Design speed 70 mph, operating speed 55 mph to 65 mph.)

2. Secondary Freeway - A divided multilane roadway designed to carry moderate volumes of traffic at moderate speeds. The facility provides for the continuous flow of traffic through full control of access and the provision of interchanges or grade separations with no access at crossroads, and no traffic signals. (Design speed 50 to 55 mph, operating speed 40 to 45 mph.)

3. Parkway - A divided multilane roadway designed for non-commercial traffic, with full or partial control of access. Grade separations are provided at major intersections and there are no traffic signals.

4. Expressway - A divided multilane roadway designed to carry heavy volumes of traffic with full or partial control of access. Interchanges are provided at major intersections. There may be access to service roads and local streets, but there will be no signalized intersections.

5. Secondary Expressway - A divided multilane roadway designed to carry moderate volumes of traffic at moderate speeds. This facility may have partial control of access, with right turn in and right turn out access to abutting property, and interchanges at major intersections. Some minor intersections may have traffic signal control.

6. Urban Arterial - Multilane roadway with signalized intersections, and access to abutting property. May have grass or barrier type median, or middle left turn lane.

7. Residential Collector Street - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.

8. Local Residential Street - Cul-de-sacs, loop streets less than 2,500 feet in length, or streets less than one mile length that do not connect

thoroughfares, or serve major traffic generators, and do not collect traffic from more than 100 dwelling units.

9. Cul-de-sac - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.

10. Frontage Road - A road that is parallel to a partial or full access-controlled facility and provides access to adjacent land.

11. Alley - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties abutting on a street.

II. Property

A. Building Setback Line - A line parallel to the street in front of which no structure shall be erected.

B. Easement - A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

C. Lot - A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. The word "lot" includes the words "plat" and parcel".

III. Subdivision

A. Subdivider - Any person, firm, corporation or official agent thereof, who subdivides or develops any land deemed to be a subdivision.

B. Subdivision - All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development and all divisions of land involving the dedication of a new street or change in existing streets; provided, however, that the following shall not be included within this definition nor subject to these regulations: (1) the combination or recombination of portions of previously platted lots where the total number of lots is not increased and the resultant lots meet or exceed the standards contained herein; (2) the division of land into parcels greater than ten acres where no street right-of-way dedication is involved; (3) widening of opening of streets; (4) the division of a tract in single ownership whose entire area is no greater than two acres into not more than three lots, where no street right-of-way dedication is

involved and where the resultant lots are equal to or exceed the standards contained herein.

C. Dedication - A gift, by the owner, or his property to another party without any consideration being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.

D. Reservation - Reservation of land does not involve any transfer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

DESIGN STANDARDS

I. Streets And Roads

The design of all roads within the municipality shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway and Transportation Officials' (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the municipality.

The proposed street layout shall be coordinated with the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

A. Right-Of-Way Widths - Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

1. Rural	Minimum ROW
a. Principal Arterial	
Freeways	350 feet
Other	200 feet
b. Minor Arterial	100 feet
c. Major Collector	100 feet
d. Minor Collector	80 feet
e. Local Road	60 feet *

2. Urban	Minimum ROW
a. Major Thoroughfares other than Freeways, Expressways, and Parkways	90 feet
b. Minor Thoroughfare	70 feet
c. Local Street	60 feet *
d. Cul-de-sac	Variable **

* The desirable minimum right-of-way (ROW) is 60 feet. If curb and gutter is provided, 50 feet of ROW is adequate on local residential streets.
** The ROW dimension will depend on radius used for vehicular turnaround. Distance from edge of pavement of turnaround to ROW should not be less than distance from edge of pavement to ROW on street approaching turnaround.

The subdivider will only be required to dedicate a maximum of 100 feet of right-of-way. In cases where over 100 feet of right-of-way is desired, the subdivider will be required only to reserve the amount in excess of 100 feet. On all cases in which right-of-way is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width right-of-way, not less than 60 feet in width, may be dedicated when adjoining undeveloped property that is owned or controlled by the subdivider, provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is subdivided, the remainder of the full required right-of-way shall be dedicated.

B. Street Widths - Widths for street and road classifications other than local shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. Local Residential
   Curb and gutter section - 26 feet, face to face of curb
   Shoulder section - 20 feet to edges of pavement, 4 foot shoulders

2. Residential Collector
   Curb and gutter section - 34 feet, face to face of curb
   Shoulder section - 20 feet to edges of pavement, 6 foot shoulders

C. Geometric Characteristics - The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-way Widths shall apply.

1. Design Speed - The design speed for a roadway should be a minimum of 5 mph greater than the

posted speed limit. The design speeds for subdivision type streets shall be:

DESIGN SPEEDS			
Facility Type	Design Speed (mph) Desirable	Minimum Level	Rolling
Rural			
Minor Collector Roads	60	50	40
Local Roads including Residential Collectors and Local Residentials	50	50*	40*
Urban			
Major Thoroughfares other than Freeways, Expressways, or Parkways	60	50	50
Minor Thoroughfares	60	50	40
Local Streets	40	40**	30**

* Based on projected annual average daily traffic of 400-750. In cases where road will serve a limited area and small number of dwelling units, minimum design speeds can be reduced further.
** Based on projected annual average daily traffic of 50-250.

2. Maximum And Minimum Grades

a. The maximum grades in percent shall be:

MAXIMUM VERTICAL GRADE IN PERCENT		
Design Speed (mph)	Terrain Level	Rolling
60	4	5
50	5	6
40	6	7
30	-	9

b. Minimum grades should not be less than 0.5%

c. Grades for the first 100 feet each way from intersections (measured from edge of pavement) shall not exceed 5.0%.

d. For streets with projected annual average daily traffic less than 250, short grades less than 500 feet long may be 150% of the values in the above table.

3. Minimum Sight Distance - No less than the minimum sight distance as shown below shall be provided. Vertical curves that connect each change in grade shall be provided as calculated using the following parameters:

SIGHT DISTANCE				
Design Speed (mph)	30	40	50	60
Stopping Sight Distance				
Minimum (feet)	200	275	400	525
Desirable (feet)	200	325	475	650
Minimum K* Value For				
Crest Vertical Curve	30	80	160	310
Sag Vertical Curve	40	70	110	160

* K is a coefficient by which the algebraic difference in grades may be multiplied to determine the length in feet of the vertical curve which will provide the desired sight distance.

General practice calls for vertical curves to be multiples of 50 feet. Calculated lengths shall be rounded up in each case where used. Sight distance provided for vehicles stopped at intersections shall be in accordance with A Policy on Geometric Design of Highways and Streets (1990).

4. The superelevation table below shows the maximum degree of curve and related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter is 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06 with 0.04 being desirable.

SUPERELEVATION TABLE			
Design Speed (mph)	Maximum Superelev (ft/ft)	Minimum Radius (feet)	Maximum Deg of Curv (deg+min)
30	.04	302'	19 00'
40	.04	573'	10 00'
50	.04	955'	6 00'
60	.04	1528'	3 45'
30	.06	273'	21 00'
40	.06	509'	11 15'
50	.06	849'	6 45'
60	.06	1380'	4 15'
30	.08	252'	22 45'
40	.08	468'	12 15'
50	.08	764'	7 30'
60	.08	1206'	4 45'

D. Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street shall intersect any other street at an angle less than sixty-five (65) degrees. No street shall intersect a railroad at grade at an angle less than sixty-five (65) degrees.

2. Property lines at intersections shall be set so that the distance from the edge of pavement, of the street turnout, to the property line shall be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line may be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for a stopped vehicle on the side street.

3. Offset intersections shall be avoided. Intersections which cannot be aligned shall be separated by a minimum length of two hundred (200) feet between survey centerlines.

E. Cul-de-sacs

Cul-de-sacs shall not be more than five hundred (500) feet in length (for control of speed, visual detection of a dead-end street, and for fire protection). The

distance from the edge of pavement on the vehicular turnaround to the right-of-way line shall not be less than the distance from the edge of pavement to the right-of-way line on the street approaching the turnaround. Cul-de-sacs shall not be used to avoid connection with an existing street or to avoid the extension of a important street.

F. Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provision is made for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.

2. The width of the alley shall be at least twenty (20) feet.

3. Deadend alleys shall be avoided where possible, but if unavoidable, shall be provided with such adequate turnaround facilities at the dead end as may be required by the Planning Board.

G. Permits For Connection To State Roads

An approved permit is required for connection to any existing State system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division Of Highways.

H. Offsets To Utility Poles

Poles for overhead utilities shall be located clear of roadway shoulders, preferably a minimum of at least thirty (30) feet from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of six (6) feet from the face of curb.

I. Wheelchair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or alterations for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

J. Horizontal Width On Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2-lane, 2-way traffic shall be as follows:

   a. Shoulder Section Approach
      i. Under 800 ADT in design year - Minimum 28 feet width face to face of parapets or rails or pavement width plus 10 feet, whichever is greater.
      ii. 800 to 2000 ADT in design year - Minimum 34 feet width face to face of parapets or rails or pavement width plus 12 feet, whichever is greater.
      iii. Over 2000 ADT in design year - Minimum width of 40 feet with a desirable width of 44 feet face to face of parapets or rails.

   b. Curb And Gutter Approach
      i. Under 800 ADT in design year - Minimum 24 feet face to face of curbs.
      ii. Over 800 ADT in design year - The width of the approach pavement measured face to face of curbs. Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face to face of parapet or rail shall be 1'6" minimum or greater if sidewalks are required.

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic shall be as follows:

   a. Shoulder Section Approach - The width of approach pavement plus width of usable shoulders on the approach left and right. (Shoulder width is 8 feet minimum and 10 feet desirable.)

   b. Curb And Gutter Approach - The width of approach pavement measured face to face of curbs.

APPENDIX E

THOROUGHFARE PLAN STREET TABULATION

Table 22 summarizes the cross section and traffic characteristics for the thoroughfares shown on the Plan. This table provides information for each roadway in a quick-reference format that parallels the written descriptions provided in Chapter 6. The entries are arranged alphabetically, except that a few of the facilities are listed alongside closely related ones. The respective roadway segments are listed sequentially from south to north or from west to east as appropriate. The table contains the recommended cross section (identified by a single capitalized letter) where it is different from the existing one. These recommended cross sections are illustrated in Figure 23. Although a roadway may be listed as adequate ("ADQ"), all pavements should be widened to achieve the standard 12-foot lane width.

Table 22 uses the following abbreviations to save space:

ADQ	adequate
CR-SECT	cross section
DIST	distance
PAV	pavement
RECOMM	recommended
ROW	right-of-way
TRAFF	traffic
UNK	unknown
fig	figure
ft	feet
mi	mile
vpd	vehicles per day

TABLE 22
SANFORD THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

ROADWAY from--to	EXISTING CROSS SECTION DIST mi	PAV ft	ROW ft	EXISTING CAPACITY (FUTURE) vpd	AVERAGE DAILY TRAFF 1990 vpd	2020 vpd	RECOMM CR-SECT PAV fig	ROW ft
AVENTS FERRY RD(NC42)								
Broadway--Longstreet	1.1	20	60	11000	2200	5000	ADQ	ADQ
BEECHTREE DRIVE [NEW]								
Canterbury--McNeill	(0.7)	--	--	(12000)	--	3000	L	60
BRAGG STREET (SR1514)								
Horner--Seventh	0.8	46	60	22000	9200	19000	ADQ	ADQ
Seventh--McIver	0.9	46	60	22000	6500	12000	ADQ	ADQ
McIver--Seventh	(0.2)	--	--	(28000)	--	6000	D	90
BRUCE COGGINS(SR1156)								
Minter--Tramway	1.9	18	50	9000	900	3000	ADQ	ADQ
Tramway--US1/15/501	(0.5)	--	--	(13000)	--	2000	L	60
BURNS DRIVE (SR1406)								
US1/15/501--Hawkins	0.7	20	60	11000	1300	3000	ADQ	ADQ
Hawkins--Colon	(0.7)	--	--	(12000)	--	3000	L	100
CANTERBURY ROAD								
Horner--Piedmont	(0.3)	--	--	(13000)	--	6000	L	80
Piedmont--US1/15/501	0.3	20	60	11000	UNK	5000	ADQ	ADQ
CARBONTON ROAD (NC42)								
Pickard--Cool Spring	4.3	20	60	11000	2100	6000	ADQ	ADQ
Cool Springs--Palmer	1.3	22	50	12000	2900	8000	ADQ	ADQ
Palmer--Carthage	0.5	36	50	16000	3000	9000	ADQ	ADQ
Carthage--Wicker	(0.1)	--	--	(16000)	--	2000	I	60
CARTHAGE ST (SR1237)								
CHARLOTTE AV (SR1002)								
US1/15/501--Fire Tow	2.0	26	60	13000	2900	6000	ADQ	ADQ
Fire Tower--Fields	0.4	26	60	13000	5600	7000	ADQ	ADQ
Fields--Carbonton	0.6	34	80	16000	7700	10000	ADQ	ADQ
Carbonton--First	0.8	60	72	28000	8300	16000	ADQ	ADQ
First--Seventh	0.5	50	72	22000	3900	8000	ADQ	ADQ
Seventh--Eleventh	0.4	46	60	22000	1800	5000	ADQ	ADQ
Eleventh--Seventeent	0.5	22	60	12000	600	5000	ADQ	ADQ
Seventeenth--San Lee	(1.0)	--	--	(13000)	--	4000	L	100
CENTER CHURCH(SR1303)								
Wilmouth--US1/15/501	2.5	20	60	12000	2300	4000	ADQ	ADQ
COOL SPRINGS (SR1325)								
Franklin--Horner	3.4	20	60	11000	2400	6000	ADQ	ADQ

TABLE 22
SANFORD THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

ROADWAY from--to	EXISTING CROSS SECTION DIST mi	PAV ft	ROW ft	EXISTING CAPACITY (FUTURE) vpd	AVERAGE DAILY TRAFF 1990 vpd	2020 vpd	RECOMM CR-SECT PAV fig	ROW ft
COURTLAND DR (SR1122)								
Tramway--Rose Exten	0.6	24	48	12000	3300	6000	ADQ	ADQ
Harkey--Woodland	0.6	24	48	12000	3900	6000	ADQ	ADQ
Woodland--Horner	0.2	20	44	10000	3900	7000	ADQ	ADQ
Horner--Third	0.1	--	44	(12000)	UNK	1000	L	ADQ
COTTEN ROAD (SR1403)								
US421--Cumnock	(0.8)	--	--	(13000)	--	7000	L	100
Cumnock--Perkinson	3.3	20	60	12000	1500	4000	ADQ	ADQ
CUMNOCK ROAD (SR1400)								
Cotten--Chatham Co	1.8	20	60	12000	1900	5000	ADQ	ADQ
DEEP RIVER RD(SR1466)								
Hawkins--Womack	0.9	22	60	(35000)	4800	19000	D	90
Womack--Colon	0.9	22	60	12000	4000	9000	ADQ	ADQ
FARRELL ROAD (SR1423)								
Lower Moncure--Alsto	1.6	18	60	11000	300	2000	ADQ	ADQ
FAYETTEVILLE HW(NC87)								
Harnett Co--US421BYP	3.4	26	80	(50000)	11700	34000	B	200
US421BYP--Cox Maddox	1.1	26	80	(16000)	13800	14000	I	ADQ
Cox Maddox--US421	(0.3)	--	--	(16000)	--	14000	I	90
FIELDS DRIVE (SR1107)								
Carthage--Horner	1.0	24	50	12000	5500	7000	ADQ	ADQ
Horner--Third	(0.3)	--	--	(16000)	--	6000	I	60
FIRE TOWER RD(SR1152)								
Tramway--Carthage	1.7	20	50	11000	1900	5000	ADQ	ADQ
FRANKLIN DR (SR1332)								
Henley--Cool Springs	2.5	18	60	12000	1700	6000	ADQ	ADQ
GARDEN ST (SR1117)								
Washington--Harkey	0.5	20	36	11000	1700	3000	ADQ	ADQ
HARKEY ROAD								
Garden--Courtland	(0.3)	--	--	(13000)	--	3000	L	60
Courtland--Woodland	0.5	18	60	12000	UNK	3000	ADQ	ADQ
Woodland--Nash	(0.9)	--	--	(16000)	--	6000	I	60

TABLE 22
SANFORD THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

ROADWAY from--to	EXISTING CROSS SECTION DIST mi	PAV ft	ROW ft	EXISTING CAPACITY (FUTURE) vpd	AVERAGE DAILY TRAFF 1990 vpd	2020 vpd	RECOMM CR-SECT PAV fig	ROW ft
HAWKINS AV (US1BU/15)								
Charlotte--Weathersp	0.5	39	45	12000	5200	7000	ADQ	ADQ
Weatherspoon--Hill	0.2	36	42	16000	11900	15000	ADQ	ADQ
Hill--Stroud	0.2	30	50	(16000)	11900	15000	I	60
Stroud--Burns	0.5	26	50	(16000)	11900	15000	I	60
Burns--McNeill	0.5	35	62	16000	9300	13000	ADQ	ADQ
McNeill--US1BYP	1.1	26	62	13000	7500	12000	ADQ	ADQ
US1BYP--Brown	3.1	70	200	48000	11500	28000	ADQ	ADQ
Brown--Chatham Co	1.6	32	200	13000	4900	8000	ADQ	ADQ
HENLEY ROAD (SR1305)								
Blackstone--Center	2.3	22	60	12000	300	4000	ADQ	ADQ
HILL AVENUE								
Horner--Hawkins	0.5	35	40	12000	UNK	2000	ADQ	ADQ
HORNER BLVD (US421)								
Southern Loop--Main	1.2	64	80	28000	16600	23000	ADQ	ADQ
Main--Fields	1.7	52	60	(28000)	21400	24000	D	90
Fields--Washington	0.3	64	70	28000	22800	23000	ADQ	ADQ
Washington--Wicker	0.4	52	60	22000	17900	20000	ADQ	ADQ
Wicker--Carthage	0.1	70	75	28000	17900	20000	ADQ	ADQ
Carthage--Bracken	0.4	52	70	22000	16200	20000	ADQ	ADQ
Bracken--Weatherspoo	0.1	70	72	28000	16200	20000	ADQ	ADQ
Weatherspoon--US1/15	0.9	52	70	22000	14000	15000	ADQ	ADQ
US1/15/501--Buffalo	0.5	52	100	28000	12500	13000	ADQ	ADQ
Buffalo Cr--US421BYP	4.0	32	150	50000	8500	10000	ADQ	ADQ
US421BYP--Chatham Co	0.8	32	150	50000	8500	17000	ADQ	ADQ
INDUSTRIAL DR(SR1239)								
Lee--Snyder	(0.2)	--	--	(13000)	--	4000	L	80
Snyder--Williams	0.9	26	75	12000	2100	5000	ADQ	ADQ
Williams--Lee	0.1	45	75	12000	2100	5000	ADQ	ADQ
KELLY DRIVE (SR1521)								
Nash--Utley	0.3	35	60	16000	4100	6000	ADQ	ADQ
Utley--Pumping Stati	1.5	18	60	9000	UNK	5000	ADQ	ADQ
LEE AVENUE (SR1133)								
St Andrew--Indus Ext	1.9	22	60	12000	6000	10000	ADQ	ADQ
Industrial--Main	0.3	52	60	(28000)	11000	14000	D	90
Main--Horner	0.7	28	48	(28000)	11000	13000	D	90

TABLE 22
SANFORD THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

ROADWAY from--to	EXISTING CROSS SECTION DIST mi	PAV ft	ROW ft	EXISTING CAPACITY (FUTURE) vpd	AVERAGE DAILY TRAFF 1990 vpd	2020 vpd	RECOMM CR-SECT PAV fig	ROW ft
LEMON SPRINGS(SR1001)								
Sheriff Watson--Sain	1.5	20	50	12000	3800	9000	ADQ	ADQ
Saint Andrews--Tramw	1.3	20	50	(28000)	3400	13000	D	80
LICK CREEK RD(SR1508)								
Lower Moncure--Popla	1.1	20	50	11000	500	1000	ADQ	ADQ
LILLINGTON HWY(US421)								
Peppermill--US421BYP	1.9	34	150	13000	6300	12000	ADQ	ADQ
US421BYP--Southern	0.8	34	150	13000	6400	10000	ADQ	ADQ
LOWER MONCURE(SR1002)								
Bragg--Eleventh	(0.3)	--	--	(13000)	--	3000	L	60
Eleventh--Farrell	4.7	18	60	11000	1600	4000	ADQ	ADQ
MCNEILL ROAD (SR1405)								
Horner--NSRR Track	(0.2)	--	--	(13000)	--	3000	L	60
NSRR Track--Beechtre	1.1	22	60	12000	2100	3000	ADQ	ADQ
MINTER SCHOOL(SR1149)								
Mulatto Cr--Saint An	2.4	18	60	9000	1200	4000	ADQ	ADQ
NASH STREET (SR1519)								
Main--Kelly	0.6	38	54	16000	7000	13000	ADQ	ADQ
Kelly--Bragg	0.3	46	60	22000	7000	13000	ADQ	ADQ
NORTHWEST CONNECTOR								
Cotten--Hawkins	(1.6)	--	--	(13000)	--	7000	L	100
PENDERGRASS (SR1334)								
US1/15/501--Franklin	1.5	20	60	11000	1700	3000	ADQ	ADQ
PERKINSON ROAD EXTENS								
Cool Springs--Hawkin	(2.8)	--	--	(13000)	--	4000	L	100
POPLAR SPRING(SR1537)								
Avent Ferry--Gunther	6.9	20	60	12000	700	4000	ADQ	ADQ
POST OFFICE (SR1418)								
Colon--Lower Moncure	2.6	18	60	9000	400	1000	ADQ	ADQ
PUMPING STAT (SR1510)								
Poplar Springs--San	2.1	18	60	11000	500	4000	ADQ	ADQ
San Lee--Lower Moncu	(0.7)	--	--	(13000)	--	11000	L	100
Lower Moncure--Colon	(2.5)	--	--	(13000)	--	9000	L	100

TABLE 22
SANFORD THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

ROADWAY from--to	EXISTING CROSS SECTION DIST mi	PAV ft	ROW ft	EXISTING CAPACITY (FUTURE) vpd	AVERAGE DAILY TRAFF 1990 vpd	2020 vpd	RECOMM CR-SECT PAV fig	ROW ft
RIDDLE ROAD (SR1416)								
Colon--Lower Moncure	2.5	22	60	12000	700	1000	ADQ	ADQ
ROSE STREET (SR1516)								
Courtland--Harkey	(0.7)	--	--	(13000)	--	5000	L	90
Harkey--Crest	(0.2)	--	--	(13000)	--	6000	L	90
Crest--Woodland	0.4	22	40	11000	UNK	6000	ADQ	ADQ
Woodland--Seventh	0.6	48	54	22000	4500	10000	ADQ	ADQ
SAINT ANDREWS(SR1146)								
Fred Stone--Tramway	4.1	18	48	9000	3100	6000	ADQ	ADQ
SAN LEE DRIVE(SR1509)								
US421BYP--Poplar Spr	1.8	24	40	13000	1400	5000	ADQ	ADQ
SANFORD BYP (US421BY)								
Fayetteville--Lillin	(1.2)	--	--	(54000)	--	21000	A	300
Lillington--Broadway	(0.9)	--	--	(54000)	--	18000	A	300
Broadway--San Lee	(2.4)	--	--	(54000)	--	24000	A	300
San Lee--Colon	(2.0)	--	--	(54000)	--	19000	A	300
Colon--US1/15/501	(1.3)	--	--	(54000)	--	21000	A	300
US1/15/501--Perkinso	(1.6)	--	--	(54000)	--	9000	A	300
Perkinson--Horner	(2.1)	--	--	(54000)	--	9000	A	300
SEVENTH ST (SR1415)								
COLON ROAD (SR1415)								
Bragg--Weatherspoon	1.3	50	60	22000	8900	16000	ADQ	ADQ
Weatherspoon--White	0.9	24	60	13000	3700	6000	ADQ	ADQ
White Oak--Riddle	(0.8)	--	--	(13000)	--	7000	L	60
Riddle--US1	5.4	24	60	13000	3100	9000	ADQ	ADQ
US1--Deep River	0.9	20	60	11000	1600	6000	ADQ	ADQ
SOUTHERN LOOP ROAD								
[PENDERGRASS](SR1334)								
[WILSON ROAD](SR1136)								
Carbonton--Steel Bri	(0.5)	--	--	(13000)	--	4000	L	100
[Steel Bridge--Fran]	0.8	20	60	11000	400	5000	L	100
Franklin--US1/15/50	(1.0)	--	--	(13000)	--	6000	L	100
US1/15/501--Main	(3.0)	--	--	(13000)	--	10000	L	100
Main--Industrial	(1.6)	--	--	(13000)	--	11000	L	100
[Industrial--Horner]	0.8	24	70	(28000)	3900	13000	D	100
Horner--Bragg	(2.9)	--	--	(13000)	--	8000	L	100

TABLE 22
SANFORD THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

ROADWAY from--to	EXISTING CROSS SECTION DIST mi	PAV ft	ROW ft	EXISTING CAPACITY (FUTURE) vpd	AVERAGE DAILY TRAFF 1990 vpd	2020 vpd	RECOMM CR-SECT PAV fig	ROW ft
SPRING LANE (SR1100)								
Cool Springs--Tangle	0.3	20	60	11000	3500	6000	ADQ	ADQ
Tanglewood--Douglas	1.1	28	60	13000	3500	9000	ADQ	ADQ
Douglas--Weatherspoo	0.7	42	60	18000	9500	13000	ADQ	ADQ
STEEL BRIDGE (SR1318)								
Pocket Cr--Carbonton	2.3	20	60	11000	1800	3000	ADQ	ADQ
TEMPTING CH (SR1322)								
Carbonton--End Pavem	1.8	20	60	11000	300	3000	ADQ	ADQ
End Pavement--Horner	(2.2)	--	--	(13000)	--	6000	L	100
THIRD STREET (SR1515)								
Horner--Weatherspoon	1.9	48	60	22000	4300	6000	ADQ	ADQ
Weatherspoon--Hawkin	(0.6)	--	--	(28000)	--	7000	D	100
TRAMWAY ROAD (NC78) MAIN STREET (NC78/42) BROADWAY ROAD (NC42)								
US1/15/501--Southern	3.3	28	60	13000	8400	11000	ADQ	ADQ
Southern--Maybee Hil	0.4	28	60	(28000)	12200	14000	D	100
Maybee Hill--Lee	0.4	38	50	(28000)	12200	14000	D	100
Lee--Nash	0.7	43	50	16000	11900	14000	ADQ	ADQ
Nash--Rosser	0.1	43	68	(28000)	13200	19000	D	100
Rosser--Cox Mill	1.7	26	68	(28000)	13200	19000	D	100
Cox Mill--Woodland	1.9	26	68	13000	6200	7000	ADQ	ADQ
US1 FRWY (US1/15/501)								
Arthur Maddox--Hicko	0.4	60	160	50000	11700	23000	ADQ	ADQ
Hickory House--Kelle	2.9	60	140	50000	14100	25000	ADQ	ADQ
Keller Andr--US421BY	3.7	64	250	54000	13200	24000	ADQ	ADQ
US421BYP--Hawkins	1.0	64	250	54000	10600	30000	ADQ	ADQ
Hawkins--Buffalo Cr	0.9	64	250	54000	6900	10000	ADQ	ADQ
Buffalo Cr--Chatham	7.3	36	180	(54000)	7700	17000	A	250
WASHINGTON AV(SR1108) VANCE STREET (SR1226)								
Garden--Vance Exten	0.1	24	50	12000	UNK	2000	ADQ	ADQ
Washington--Gary	(0.2)	--	--	(16000)	--	2000	I	60
Gary--Oakdale	0.1	32	35	12000	UNK	2000	ADQ	ADQ
Oakdale--Fields	0.1	20	45	12000	UNK	2000	ADQ	ADQ
Fields--Carthage	0.8	47	55	22000	UNK	6000	ADQ	ADQ
Carthage--Weatherspo	0.5	30	35	12000	UNK	3000	ADQ	ADQ
Weatherspoon--Spring	(0.1)	--	--	(16000)	--	3000	I	60

TABLE 22
SANFORD THOROUGHFARE PLAN STREET TABULATION AND RECOMMENDATIONS

ROADWAY from--to	EXISTING CROSS SECTION DIST mi	PAV ft	ROW ft	EXISTING CAPACITY (FUTURE) vpd	AVERAGE DAILY TRAFF 1990 vpd	2020 vpd	RECOMM CR-SECT PAV fig	ROW ft
WEATHERSPOON (SR1560)								
Carbonton--Brinn	(0.2)	--	--	(16000)	--	3000	I	60
Brinn--Vance	0.2	32	38	12000	UNK	3000	ADQ	ADQ
Vance--Gulf	0.1	24	35	12000	UNK	3000	ADQ	ADQ
Gulf--Horner	0.1	32	38	12000	UNK	6000	ADQ	ADQ
Horner--Hawkins	0.4	44	50	22000	5100	6000	ADQ	ADQ
Hawkins--Seventh	0.7	28	60	12000	8500	10000	ADQ	ADQ
WICKER STREET (NC42)								
MCIVER STREET								
Carbonton--Franklin	0.8	22	60	11000	2800	4000	ADQ	ADQ
Franklin--Chippendal	0.4	34	60	16000	5600	9000	ADQ	ADQ
Chippendale--Arbor	1.5	22	60	12000	6000	10000	ADQ	ADQ
Arbor--Carthage	0.2	48	60	22000	6000	10000	ADQ	ADQ
Carthage--Horner	0.6	48	60	22000	9100	15000	H	ADQ
Horner--Chatham	0.2	48	50	12000	7300	10000	ADQ	ADQ
Chatham--Seventh	0.6	35	40	16000	UNK	9000	ADQ	ADQ
WILKINS DRIVE(SR1328)								
OLD CARBONTON(SR1329)								
Carbonton--Horner	2.0	22	50	12000	2100	7000	ADQ	ADQ
WILSON ROAD (SR1136)								
Industrial--Fayettev	0.8	24	70	(28000)	3900	13000	D	100
WOODLAND AVE (SR1119)								
EVERGREEN STREET								
Main--Evergreen	1.4	44	50	12000	6400	10000	ADQ	ADQ
Woodland--Fields	0.2	16	UNK	8000	UNK	2000	ADQ	ADQ

THOROUGHFARE CROSS SECTIONS

CROSS SECTION EXPLANATIONS

The typical cross sections for thoroughfares shown in the Thoroughfare Plan are described below and shown in Figure 23.

Cross Section A shows a controlled-access freeway. The 46-foot grassed median is the minimum width, and 70 feet is desirable. The 228-foot right-of-way width is the minimum, and 300 feet is desirable. Slopes of 8:1 into 3-foot drainage ditches in the median are desirable for traffic safety.

Cross Section B is typical for four-lane divided highways in rural areas which have only partial control of access or none at all. The minimum median with is 30 feet, but wider is desirable. Design requirements for slopes and drainage are similar to Cross Section A.

Cross Section C and Cross Section D are used for major thoroughfares in urban areas where frequent left turns are anticipated because of abutting property development or frequent street intersections.

Cross Section E and Cross Section F are used for major thoroughfares in urban areas where left turns and intersecting streets occur infrequently. Left turns would be restricted to a few selected intersections. These cross sections are not as universal as Cross Sections C and D.

Cross Section G is appropriate for urban boulevards or parkways and is used to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. The minimum median width is 24 feet, and 30 feet is desirable.

Cross Section H is used for major thoroughfares in urban areas where projected travel exceeds the capability of a two-lane or three-lane roadway, left turns are infrequent, and right-of-way is restricted.

Cross Section I is often used for streets which must carry one-way traffic, although it could also be used for an urban thoroughfare with low volumes of traffic but high numbers of left turns.

Cross Section J and Cross Section K are used for minor thoroughfares which serve both traffic and land service functions. Cross Section J provides more parking capacity for thoroughfares which must serve more concentrated development. These sections are rarely appropriate as on-street parking is undesirable.

Cross Section L is used in rural areas or for staged construction of wider multilane roadways. This cross section may be adequate for some thoroughfares where projected travel volumes are low even far into the future.

Cross Section M is used for urban thoroughfares which will serve very high volumes of traffic. Left turn lanes would be provided in the raised median area at major intersections.

Cross Section N is used for segments of freeway which will carry higher volumes of traffic than Cross Section A. The minimum median width is 30 feet, but 70 feet is desirable.

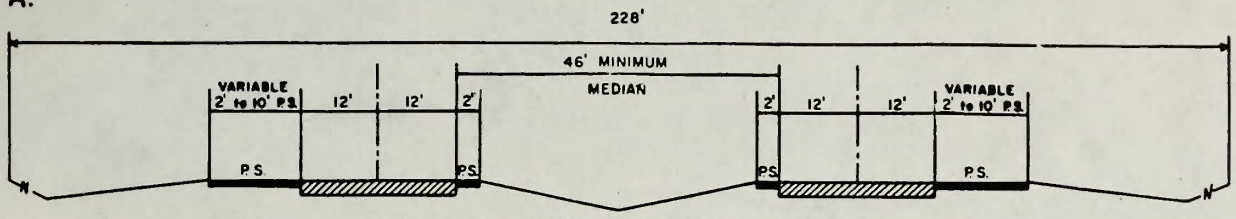
The curb and gutter urban cross sections show the sidewalks adjacent to the curb with a utility strip between the sidewalk and the right-of-way line. This spacing permits adequate setback for utility poles. If the sidewalk is moved away from the street to provide separation for pedestrians or for aesthetic purposes, then additional right-of-way must be added to insure sufficient setback for utility features.

The right-of-way shown for the typical cross sections is the minimum required to contain the street, sidewalks, utilities, and drainage structures. Topography, geology, and cut and fill requirements often require additional right-of-way, or construction easements. Recommended cross sections for thoroughfares were derived from projected traffic, existing capacities, desired levels of service, and available right-of-way. Table 22 in Appendix E shows the ultimate required right-of-way for the various thoroughfares, and this value supersedes the general values shown in Figure 23.

If sufficient bicycle traffic along the thoroughfare exists to justify a bike lane or bikeway, then additional right-of-way must be added to accommodate bicycle facilities. The Guide for the Development of Bicycle Facilities (1991) by the American Association of State Highway and Transportation Officials (AASHTO) provides information on design standards for bicycle facilities.

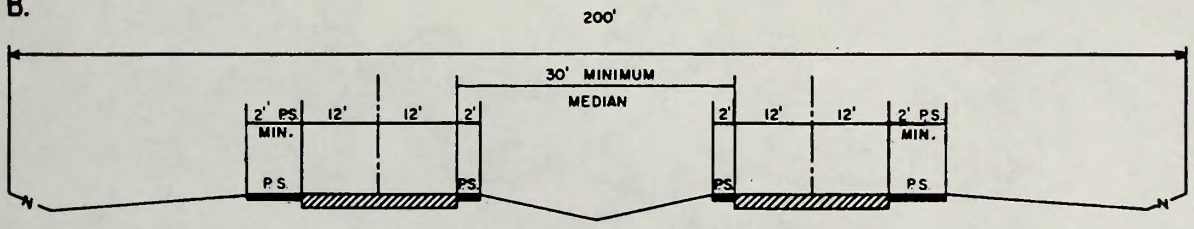
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



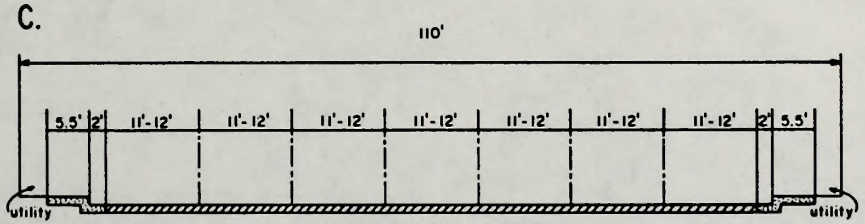
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



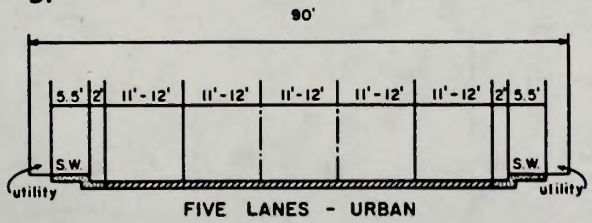
FOUR LANES DIVIDED WITH MEDIAN - RURAL

C.



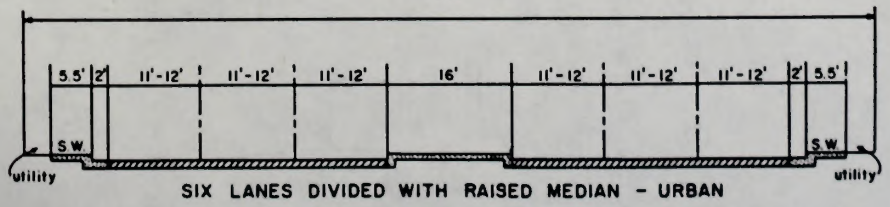
SEVEN LANES - URBAN

D.



FIVE LANES - URBAN

E.



SIX LANES DIVIDED WITH RAISED MEDIAN - URBAN

FIGURE 23

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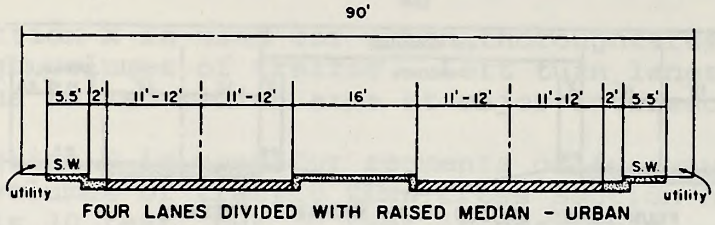
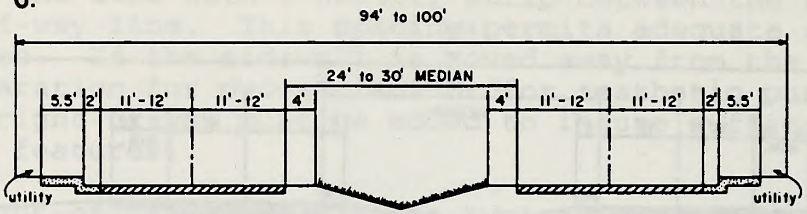
TYPICAL THOROUGHFARE CROSS SECTIONS
(CONTINUED)

F.



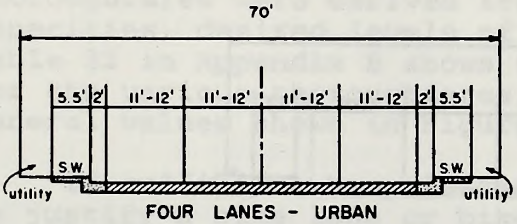
FOUR LANES DIVIDED WITH RAISED MEDIAN - URBAN

G.



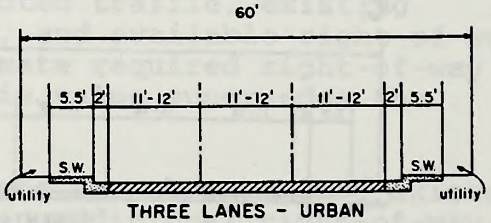
FOUR LANES DIVIDED - URBAN BOULEVARD
GRASS MEDIAN

H.



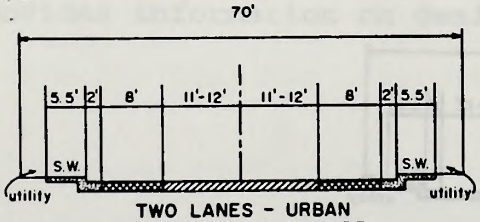
FOUR LANES - URBAN

I.



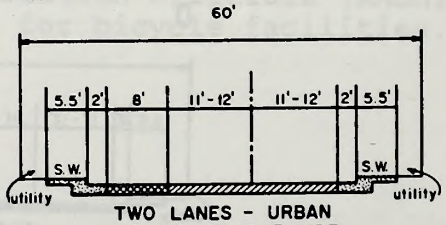
THREE LANES - URBAN

J.



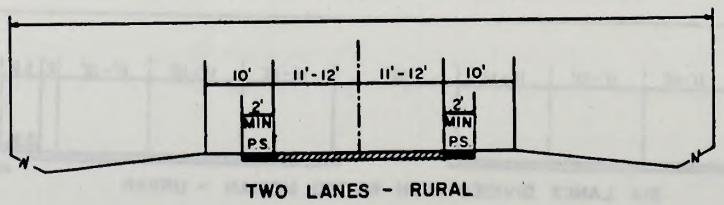
TWO LANES - URBAN
PARKING ON EACH SIDE

K.



TWO LANES - URBAN
PARKING ON ONE SIDE

L.



TWO LANES - RURAL